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SCIENCE AND INDUSTRY

OCT 20 1934

POPULAR AVIATION

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The New Ryan S-T.
See Page 286

HERMAN R. Bollin

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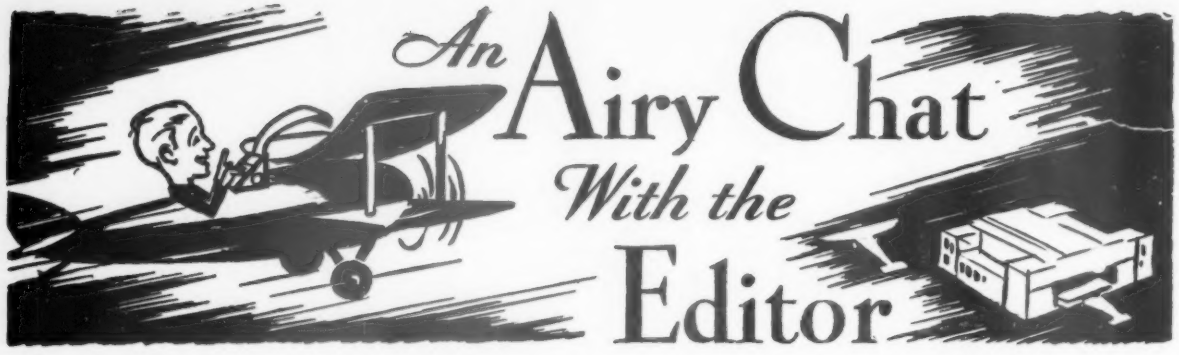

An Airy Chat With the Editor

A GOOD deal of attention was centered on the article in our September issue by E. Stanton Brown, commissioned by P.A. to investigate the mysterious death of the two Yank transatlantic flyers, Girenas and Darius, over Nazi territory.

P.A. maintained that these two brave airmen, while of Lithuanian descent, were entitled to at least an investigation in deference to their memories, since they were American citizens by adoption. It is a sad day when American nationals can have any mysterious fate befall them in a foreign land without the strong arm of Uncle Sam reaching out to demand at least a reasonable explanation.

We feel, that if these Nazis have simply "liquidated" these courageous Yanks because they didn't like American airplanes flying over their concentration camps, something should and must be done about it.

P.A. will not rest until the truth is fully elaborated and the Nazis either absolve themselves from the suspicious circumstances surrounding the case or are brought to task by official action of our government. It is not sufficient to decent men to allow this bloody business to go unchallenged.

The writer admits that he has a strong personal bias against the Nazis and in view of their bold substitution of murder for the fair processes of Justice, prevailing in other civilized countries, is quite prepared to believe the worst where they are concerned.

However, since our only desire was to bring light to this unfortunate tragedy, we were quite ready to give the Nazis themselves a fair opportunity to state their side of the matter if they felt so inclined. We desired to conduct our investigation in the highest standards of American journalism, no matter where our beliefs and sympathies lay.

In contrast to the dignified and manly commendation of the Lithuanians, the scurrilous, nasty letters received from Nazis is a revelation in bad manners.

The LITHUANIAN AMERICAN CATHOLIC STUDENTS ORGANIZATION writes: "Every Lithuanian and American of Lithuanian extraction, together with millions of their sincere friends throughout the world, deeply resent this treacherous and murderous deed—in the killing of Darius and Girenas by the German Nazis. Our nationality is indeed proud to have your outstanding moral support in this great issue for JUSTICE and TRUTH, which your magazine upholds."

Another reader, whom we believe by his name to be of Lithuanian parentage, expresses it fluently in his letter which we quote in entirety:

Editor "Popular Aviation"
Chicago, Ill.
Dear Sir:

Permit me to express my gratitude for your article "Did the Nazis Shoot Down Yank Transatlantic Flyers?" in the September issue. The aviation press should have taken up this question a long time ago and try to have it settled one way or another. Lithuania, being a small country, and having as its neighbor big Germany, whose bullying proclivities are well-known, is in no position to say the whole truth, which is probably known to her leaders. But the American press is free. And the mysterious death of two American doughboys is a matter which concerns not only Lithuanians.

Sincerely, * * *

In Memoriam

DOUGLAS DAVIS, Atlanta, Georgia, became a victim of airplane racing when his plane crashed at the Cleveland races.

He crashed to his death during the Thompson Trophy race before thousands of onlookers who are expected to learn from the air races that aviation is a progressive industry and deserving of popular support!

When he crashed, the crowd stood up and bared their heads at the sight of a brave but rash man dying. This was most certainly a fine spectacle to witness, particularly when the affair was conducted as a "sport." How long must this sort of thing continue?

On the other side of the fence, a gentleman (sic!) named Erich Deubel, writes a typically representative Nazi letter. He accuses P.A. among other things of being allied with the "Sozialists" (his own spelling) and assures us that as long as we elect to dish out "such drash" (still staying with the gentleman's letter exactly) he and his friends will boycott our magazine. (We're worried as hell.)

Mr. Deubel, alluding to our staff correspondent, uses such gentle terms in describing him as "lousy," etc., and proceeds to show his kind respect for two brave dead men by calling into question their intelligence as flyers, stating that *competent* technical men warned them against undertaking the flight.

Alluding to Goering, generally recognized as a common ruffian in civilized circles, he feels with some heat that a little mug like us (the writer is six feet tall and served a year with Uncle Sam's Air service) is hardly able to recognize such sterling manhood when we see it.

This, and more tripe like it, can hardly have any affect on our determination to see this thing through until justice is done one way or another. It only serves to substantiate our bias against the Nazi type of mind, and to thank God that if they ever try their own peculiar type of bloodletting in this country, we will probably hang every one of them.

Expressions from liberal Germans, incidentally who suffer more than any one from the knowledge of the degrading tyranny practiced by Nazidom in their own fair country, have been highly commendatory.

Also, incidentally, a few hard looking individuals have been seen hanging around our offices and keeping it under surveillance. (We don't mind, boys. If it gives you any pleasure, go to it!)

The writer doesn't mind saying that POPULAR AVIATION is determined to see this thing through. WE ARE GOING TO LEARN WHAT THE TRUTH IS. No kind of intimidation is going to stop us, and anyone who thinks it will can paste that in his hat.

The Publisher.

* * *

OUR READERS will undoubtedly be interested in that fact that the T. O. M. Sopwith entered in the International Yacht races is the same T. O. M. Sopwith who was an outstand-

(Concluded on page 324)

POPULAR AVIATION

Including SOUTHERN AVIATION and AERONAUTICS

A MAGAZINE FOR THE PROMOTION OF AMATEUR AVIATION AND PRIVATE FLYING

Volume XV NOVEMBER, 1934 Number 5

NRA CODE

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XUM

Our Bombing Squadrons

by

T-2003

Expert in military aviation and military tactics.

Photo by U. S. Army Air Corps

A direct hit with an aerial bomb on an obsolete battleship made during flight maneuvers.

THROUGH the black night the invading fleet steams on. The ships, though darkened, are throbbing with life; the crew, sure of impending victory, moves quietly and confidently at their tasks.

An inferior fleet awaits them at America's eastern seaboard, for war has caught the United States unaware, its main battle fleet in the Pacific and the Panama Canal disabled by sabotage.

The invaders, forming the Advance Force of several European powers allied against us, have in their main body six battleships and three aircraft carriers, with a number of light cruisers, destroyers, and submarines ahead and around it, convoying the troops and the Advance Air Units, which will force a landing on our shores. The American Scouting Fleet has but three battleships, a battle cruiser, and two carriers, with other auxiliary craft.

Fleet strength is reckoned in terms of capital ships and tonnage. Without some other support the defenders are beaten before they start. They cannot possibly hope to engage the invaders. Both know it, hence the confidence of the latter as they near their objective.

A merchantman, blundering within sight of the advance guard of destroyers, raps out a warning radio message to the Arlington station. Guns flash and the merchantman is sunk for his patriotic effort. An hour later, an American submarine partly submerged far off the Georgia coast, hears the thundering of screws, bobs up in the night, lets the fleet go by and then radios the full news of speed, course, location and probable size of the invader.

The latter, although aware of having been discovered, moves on. He has the preponderance of capital ships and that spells victory!

* * *

IN the headquarters of the 2nd Air Division of the General Headquarters Air Force, Richmond, Virginia, the Division Commander and his staff follow the course of events on a wall map. Their interest is more than casual. One hundred miles north, in the nation's capital, the army and navy high commands had held hurried and worried consultation; turning at last to a hitherto silent member of their council, the Chief of the Army Air Corps. Within five minutes he had demonstrated the solution; a plan for the temporary support of the small naval force in the Atlantic by the GHQ Air Force of the Army Air Corps.

The entire 2nd Air Division, plus one group of headquarters pursuit aviation, had been assigned the task in question.

The 3rd Attack Group from Barksdale Field, La., the 8th Pursuit, now the Fighter Group, and the 2nd Bombardment Group from Langley Field, Va., and the 12th Observation Group from Brooks Field, Texas, formed the new-born air division; while from Selfridge Field, Michigan, came the 1st Pursuit Group to aid the division in its mission.

In tide-water Virginia the army air units chose their airdromes. The squadron and group commanders, junior in rank but high in experience, are suddenly vested with a new importance. Especially is this true of the major commanding the bombardment group, the basic arm of the striking air force.

Twelve hours after the declaration of war, the bombardment group had quit its home station at Langley Field and had flown the few miles to Tappahannock, there to occupy individual squadron airdromes. Hour after hour they had then flown in tactical maneuvers and bombing and gunnery tactics and practice.

A fourth tactical squadron, the 235th let us call it, had been organized to augment the old 20th, 49th, and 96th Squadrons of the group. Already the group commander had received orders from his superiors on the coming operations! A paragraph stands out, bordered in blue pencil by his assistant:

"The 2d Bomb. Gp., supported by the 8th Ftr. Gp. and the 3d Atk. Gp., will go on the alert at 4:00 A. M., 15 June, prepared to destroy aircraft carriers and capital ships of the hostile fleet."

Thus, coldly and tritely, in the conventional form of air combat orders,

Photo by U. S. Army Air Corps

A 2,000-pound aerial bomb which is capable of wielding a tremendous blow to enemy ships.

Meet a Hostile Fleet

IN this instructive and interesting story, the author describes the step-by-step operations followed by the U. S. Army Air Corps in combating a mythical invading enemy fleet. It is a gripping authentic story by an expert, woven about the equipment and personnel of our air force.

Photo by U. S. Army Air Corps

A bombing plane drops a heavy bomb close to an obsolete battleship for practice. The tremendous water pressure thus created, crushes the hull of the ship.

it states his mission. From here on he was on his own. More than on his own, for it was he who would make the other assignments of time and place that would tie the supporting units in with his group when the time came to strike.

It is the mysterious hour beloved by imaginative writers of mystery stories, three-thirty by the synchronized clock in his Operations Office. His small staff busy themselves at maps, orders, telephoned instructions and reports. Several times in his military career the commander had visualized himself in such a situation, but how different this one really was. So little fuss and commotion; so little for even him—the commander—to do; with the staff taking the weight of details from his shoulders.

A 'phone rings—from Division Headquarters, for the group commander. "G-3, Second Division, Richmond, speaking." (Needn't be so damned formal, though; but he always did take himself seriously, the Brass Hat.) "Report just received here, the 12th Observation Group has taken off. Yes, from Cape Hatteras, at 3:15 A. M., to search for the invading fleet.

"The weather? Oh, hazy from Hatteras to the Virginia Capes, light easterly wind, haze clearing to sea. Half-hourly weather reports'll be radioed you from Hatteras, starting four o'clock."

He hangs up as a staff aide comes in from a tour of the squadron airdromes, reporting all planes serviced and loaded with bombs, engines warmed up, and crews ready to go. At each squadron an experienced naval officer is instructing the flying crews on basic naval tactics and showing silhouettes of the various classes and types of ships in the enemy fleet. The staff works on.

Again the 'phone rings as the squadron commanders report from their respective airdromes. It is four o'clock. The squadrons have all checked in. The 2nd Bombardment Group is on the alert!

At another point, many miles distant and 180 miles off-shore from Hatteras, the situation is equally tense. Just at daybreak in the thinning haze, the crew of one of the score of observation planes reconnoitering off-shore picks up a destroyer of the enemy fleet.

A few minutes later, another observer reports himself directly over the fleet main body, the fleet proceeding at 21 knots at about 320 degrees, size O.K. as previously reported. Radio bearing stations along the coast get the airplane's signals and by cross-bearings establish its position and that of the enemy fleet as 150 miles off the cape.

The messages cease for a while. The two planes venturing low have been driven off by savage bursts of machine-gun fire from some of the surface craft. Up into the haze they go to the eastward, shrouded there in darkness from the watchful eyes of the naval anti-aircraft crews. From there they will track the fleet as long as possible, so they finally report, and establish direct radio contact with the bomber group ashore. By 4:42 A. M. the bombing commander has recorded the position and route of the invading fleet.

As the signal sergeant enters with the last-minute weather and wind-aloft data, the major notes the lifting of darkness, then settles down to his navigation and time schedule and the last issuance of formal orders. He designates the place, time, and altitude of the group assembly point and other important items of the job in hand. Carefully, slowly, distinctly, they are 'phoned to the squadron commanders.

At the squadron airdromes, engines are started and flying crews buckle on flying gear, parachutes and kapok jackets. Fifteen minutes later, the four commanders have given their orders, the ships of the squadrons have cleared their respective airdromes and are converging in the skies.

Urbana, at 5,000 feet; straight to their assembly point the squadrons fly, without circling or stalling. The ten-plane javelins thunder on to their rendezvous, each squadron slipping in to its place on the second. In the rear plane of the leading 20th Squadron "the old man" flies, his air navigation data

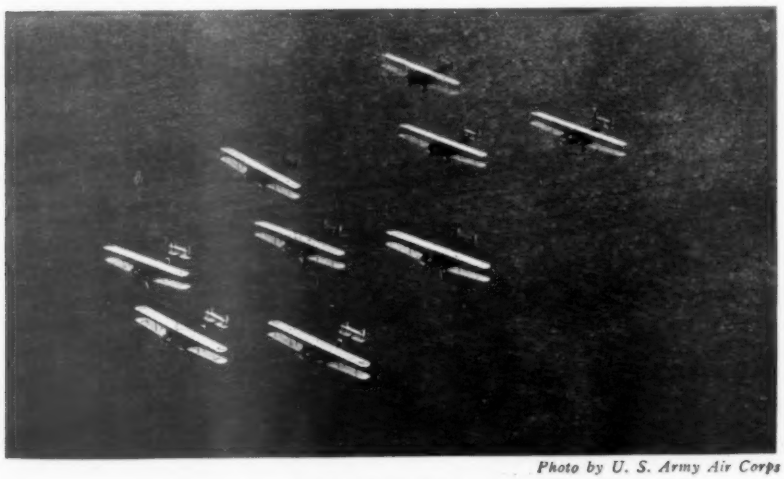

Photo by U. S. Army Air Corps

A squadron of bombing planes on the way to the attack.

before him. His bombardier, in the cockpit before him, is skilled in his work, an ex-bomber pilot and an Air Corps graduate of the Naval War College at Newport.

The forty bi-motors cluster in a tight group wedge formation. How different their appearance from that of the week before. Chrome yellow wings and olive drab fuselages of peace time are no more. Viewed from below each plane is a light blue, flecked with white, to blend with the azure depths of the sky to watchful, and perhaps hostile, eyes on the ground or sea.

From above they are a dull mottled color, running to dark green, to match the fields of Virginia at this season and so be camouflaged from hostile air observation while parked at their home airdromes. (This tight formation they were in; really no need of that stuff right now, except as a sort of gesture. Looked pretty. Kept the old chin up! Especially the 49th there with its wolf's head insignia; only one flying team left of the old roster of last week.)

The old-timers were on staff jobs mostly; the newcomers all reservists, but all Group I, ready to take their places in combat outfits without refresher training.

And on to their objectives roars this striking force of the Air Corps. Langley Field, almost deserted, is soon passed. These huge layouts, excellent for training purposes in times of peace, are no places to be caught in by a marauding group of enemy attack or bombardment aviation. Too many eggs in one basket.

The commander's earphones sound hollowly:

"From Air Division—6:20 A. M.—observation again reports fleet main body, this time at longitude 73 degrees, latitude 35 degrees, at 5:53, speed 21 knots, track 320 degrees true, acknowledge, please."

The gunner-radioman in the rear cockpit, also a pilot, takes the stick while the commander prepares his interception data. He must know his time of departure from Hatteras, his air-speed, the wind, and the movement of the fleet, and resolve them all into a dot on the chart where interception with the fleet will take place. In four minutes he lays his chart aside and shakes the stick, taking it from his subordinate in the rear.

An element of three Martin monoplane bombers, B-10's, on a mission such as described in this article. These bombers are very speedy and well armed so that they can normally dispense with an escort of pursuit planes.

Cape Hatteras, 6:35½ A. M. A half minute early, but good enough. Far below him the attack group is winging out over the water. A thousand feet directly above the bombers, the two-squadron group of two-seater fighters take their place. The entire air division is on its way!

Barely visible in the bright sky, the high flying pursuit planes from Air Force Headquarters start pulling ahead toward the fleet, the pursuit commander having received his navigation data from the bombing chief. One hundred and thirty miles to go, it will be 7:20 before they attack. The American naval commander will be vitally concerned and the bombardment chief has the time of attack radioed in code to Division Headquarters.

Two fast single-seaters bear alongside the bombing group. They carry the Division and Air Force commanders, come to look things over from the air. For a few minutes they talk with short range radio to the commander of the bombers, then pull away to return to their headquarters before the battle begins.

The group commander, now in direct charge of this operation, takes stock of the situation. His squadron leads, followed by a squadron on either flank, with the fourth squadron bringing up the rear. Each nine-ship squadron is in javelin formation, or column of three-ship flights, each flight in V-formation.

The two squadrons of fighters above him are ploughing along just as steadily. Their job is to displace enemy pursuiters who might attempt to fly above the bombers out of machine-gun range, and drop small time-fused bombs upon the bomb-laden formation.

The pursuiters, now almost out of sight, go out to pick a fight if they can. The four eighteen-plane squadrons of attack aviation, augmented by a composite squadron of navy torpedo planes, are also there to support the bombardment, the attack planes by strafing the anti-aircraft personnel on the battleships and aircraft carriers; the torpedo carriers by direct assault on these capital ships.

Other matters now occupy the commander's mind. Within 60 miles of the enemy his radio broadcasts the radio silence command to his own and the supporting units. Tactics would now move according to a pattern wherever possible. Radio, when in close contact with the enemy, must not be relied upon.

Their first sight of the enemy fleet comes from the air; a trio of scouting planes from an enemy carrier, easing into view some miles away, then vanishing into the early morning haze to the east. The rocking-wing signal of the leading squadron commander, the deputy leader, is almost unnecessary. Smoothly, although slowly, the squad-

(Continued on page 329)

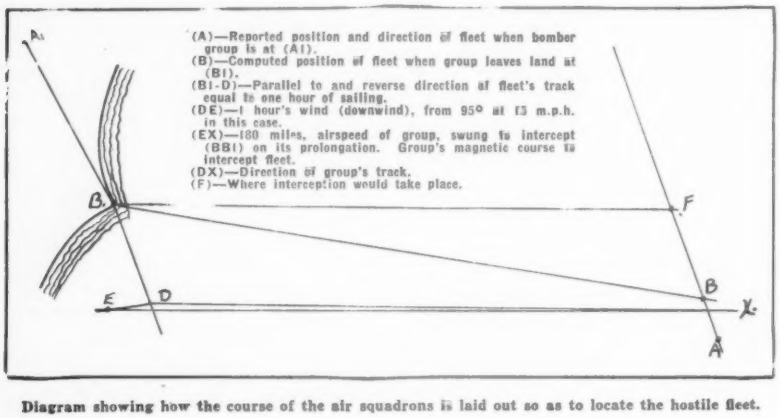
(A)—Reported position and direction of fleet when bomber group is at (A1).
(B)—Computed position of fleet when group leaves land at (B1).
(B1-D)—Parallel to and reverse direction of fleet's track equal to one hour of sailing.
(DE)—1 hour's wind (downwind), from 95° at 13 m.p.h. in this case.
(EX)—180 miles, airspeed of group, swung to intercept (BB1) on its prolongation. Group's magnetic course to intercept fleet.
(DX)—Direction of group's track.
(F)—Where interception would take place.
A1
B
F
B1
E
D
X
A

Diagram showing how the course of the air squadrons is laid out so as to locate the hostile fleet.

A Biography of Colonel Thaw II

by IRVING J. NEWMAN

An intimate story of a modest and reticent World War hero and pioneer in aviation who, to date, has received but little attention. His experience as a war pilot was second to none.

"NO aviator that ever lived had a broader experience as a war pilot than he."

Colonel William Thaw II, who resisted Spandaus and Archies through four years of war, finally fell prey to a tiny germ. On April 22, in his fortieth year and after an illness of barely a week, he died of pneumonia in his Pittsburgh home.

To socialite Pittsburghers, it meant the loss of one of their beloved playfellows, a scion of a respected old family. To the man on the street, it recalled blaring headlines over stories of battles in the air —the fury of war on fragile wings.

To the few survivors of Squadron N-124, the "Escadrille Lafayette," it meant the loss of a comrade—the only member of their famed clan who survived through its period of existence. His neighbors thought of him as the possessor of a proud name, respected since that day more than a century ago when the first William Thaw crossed the mountains to settle where the Allegheny and Monongehela Rivers join to form the Ohio.

A portrait of Colonel William (Bill) Thaw II, with his dog "Wink." It is autographed, "To father from William and Wink." An outstanding hero of the war greatly admired by his fellow members of the Escadrille Lafayette.

In the boarded family mansion in the exclusive Morewood Avenue district, his room bears evidence of his mode of living. No broken propellers, no strips of torn fabric are found on his walls. They are bare as the cubicle of a monk.

The relics of twenty years of flying were not displayed; there were no rows of medals to make their annual appearance for the Armistice Day parade; no airplane bore his name; the fading relics of glory he once chose to share now remained but dust covered mementos in the attic of his empty home.

Dusty, some carelessly framed, others merely tacked to the walls, were the relics that for years were Thaw's only tangible reminders of his pioneering days in the air. Instead of "whiskey" and "soda," the bizarre lion cub mascots of his days in France, in Pittsburgh two prosaic Dachshunds ran together through the rooms of the old mansion the day after Thaw's death.

One of them sniffed at a frame on the floor leaning against the wall of the attic. It contained the officer's certificate of the Ordre National de la Legion d'Honneur together with the medal and its famed rosette, the highest honor France can give to her heroes.

Nearby hung a certificate of graduation from the Curtiss School of Aviation, dated August 8, 1913. Among photographs of crashes and portraits of comrades was a torn piece of fuselage fabric bearing the Indian head, insigne of the Escadrille.

Also could be seen his Croix de Guerre with its two stars and seven palms, the diplomas and medals of valor from the areo clubs of America and France, the First Class Military Medal of Montenegro, the Distinguished Service Cross with the bronze oak leaf and the two citations signed by General Pershing.

Thaw spent his early life in Pittsburgh, his birthplace. Following his schooling in New York and Pennsylvania and at Yale (1911-1913), he surprised his family and classmates by interesting himself in those new-fangled flying machines. He earned his wings, in itself an achievement in those days, at the Curtiss School in Hammondsport, N. Y., becoming in three months a proficient pilot of the Curtiss Model E Hydro.

He anticipated contact by airplanes of ships in quarantine and startled the world by making the first shore-to-shore airplane delivery, flying from Newport via New Haven and dropping a package of papers on the liner "Imperator" sailing into New York. On the way back, he shocked the city slickers of Manhattan by flying under the spans of four East River bridges and circling the Statue of Liberty.

In 1914, Thaw's brother, Alexander had invented an automatic stabilizer and the two brothers went to Europe in an effort to sell the device to the French government. The war interrupted their plans. Later, Alexander, as lieutenant and commander of the 135th American Aero Squadron, was killed in an airplane accident at Fere-en-Tarenoir, France.

Thaw, following some flights at Juan-les-Pins and other points on the Mediterranean, attempted to enlist as a French army flyer. His efforts, however, were frowned upon. It was believed that many German spies were posing as alien neutral citizens in France, and in addition, the French army had more applicants for flyers than it could train.

Undaunted, this Yale man, this son of the social elite, enlisted in the Foreign Legion as a common infantry private (August 21, 1914). He was promoted to private, first class, following a brief training at Rouen and Toulouse, arriving in the front line trenches (Chemin-des-Dames) in December.

While stationed at Camp de Mailly, near Chalons-sur-Marne about this time, Thaw met James Bach and Bert Hall, other American Legionnaires with similar desires. The three visited Captain de Georges of French Aviation Escadrille D-6. De Georges was commander of a squadron of biplace De-

perdussin monoplanes with 80 horsepower Gnome rotaries, used as "avions militaire" in the early part of the war and later suppressed.

Interested in the case of the Americans, de Georges arranged for the transfer of Bach, but not Thaw. Thaw was so worried for fear he had been forgotten that he walked thirty-two kilometers from his post to the D-6 aerodrome. This time he interested Lieutenant Bocard, senior pilot and later commander of the Bureau de Sous-Secretaire d'Etat de l'Aeronautique, who arranged for his transfer direct from the trenches to D-6 as a "soldat-mitrailleur."

This term was applied to machine-gunners, although the only weapons used in the air at that time were automatic pistols and carbines. Because he was anxious to fly, he convinced his officers that he could pilot anything, although his only experience had been in hydros. He was made an observer, nevertheless, and was not sent to the Saint-Cyr School until February.

At the school he soloed the Coudron G-2, then France's fastest combat plane, although he had never even seen one before this. After a month of training and being made a pilot in the French Air Service with Brevet Militaire No. 714, he met Norman Prince who outlined to him the plans for a squadron of American flyers.

Prince, who had come from Pride's Crossing, Mass., with a Burgess Flying School classmate, Frazier Curtis, is really given credit for forming the Escadrille Lafayette. Thaw is often named as one of its organizers, but modestly disclaimed this credit, having said that in his anxiety to be sent to the front as a pilot, he would be luke-warm toward any plan to defer this transfer (such as the formation of a squadron of Americans).

Probably the only photo ever made of the Escadrille wine bottle. It is shown resting on one of Thaw's French uniforms.

Prince's plan appealed to the French authorities, however, in spite of the growing popularity of flying among the French soldiers. This friendly international gesture appealed to the romantic French mind.

While Prince, Curtis, and Elliott Cowdin went ahead with the plans, Thaw, Hall, and Bach, in spite of orders to proceed to Pau with the other Americans, asked the French Ministry of War for immediate transfer to the front; their request was granted. Prince and Cowdin later also went to the front in a Voisin squadron.

Meanwhile, Thaw with Squadron C-42 at Luneville and Nancy, had earned the distinction of being the first to fly a Coudron twin-motor at the front, and rapidly became proficient in every type of French fighting aircraft using revolvers, rifles, rockets and later machine guns. As in peace he was known by his modesty, so in combat his fame spread because he "fought with his head as well as his nerve."

He learned precise maneuvering and knew how to judge the exact position and moment for attack. He was the "brain trust" of the air warriors. He was never frightened, never flustered nor excited. The giant "T" on Thaw's plane, like Gervais Raoul Lufbery's swastika, gave heart to fledglings fresh from the training aerodromes when they glimpsed it flying at their sides. His flying was characterized more by level headed judgment and consistent victory than by outstanding feats of reckless daring.

Unassuming, he disliked interviews and photographers; his name appeared in print less often than many whose exploits were less deserving of mention. As plans for the Escadrille Americaine became more complete, Thaw gave it his support and transferred as second in command to N-65 at Bar-le-Duc with Cowdin where they awaited other Americans. On April 15, 1916, the American pilots assembled at Luxeuil.

The original members included, besides Thaw and Lufbery, Didier Masson, James Bach, and Bert Hall. Later Cowdin, Prince, James McConnell, Clyde Buckley, Chouteau Johnson, and Lawrence Rumsey, all breveted pilots, came into the fold. Of the original group, Thaw was the only one who remained throughout the Escadrille's existence.

This was the nucleus, whose soul was Thaw and Lufbery, of the organization that once boasted they could give Richtofen's Circus odds in engine power and altitude and still fight it to a standstill.

In May, just as Thaw had been commissioned First Lieutenant, he was shot in the arm in combat. Other bullets piereed his motor and gas tank and shot away most of the tail of his plane, but he landed safely. After a short convalescence, he assumed command of the squadran (October 17, 1917), and

Colonel William Thaw II, in a French Escadrille uniform. This photo was found in an old book belonging to Thaw.

the following month was transferred to the United States Army, commissioned Major.

Later, in spite of poor vision in one eye, defective hearing and a knee injury, he was given command of the 103rd Pursuit Squadron (American Lafayette Escadrille), later to command the Third Pursuit Group of five squadrons. He lead these units to victory at Champagne, Chemen-des-Dames, Flanders, and Toul, and in the St. Mihiel, Verdun, and Meuse-Argonne offensives.

In the same Pittsburgh attic, where his family was now searching for the missing certificate that Thaw prized the most—the French Hydroaeroplane license No. 2 (he was the second brevet of the Aero Club of France), and also below in the disordered bedroom where Thaw, just before his illness, was sorting uniforms and mementos preparatory to moving, were found living evidences of his heroic achievements.

These records in themselves could almost serve as a history of the Great War. One of the Pershing citations, for instance, read in part:

"For extraordinary heroism in action near Rheims, March 26, 1918. Major Thaw was the leader of three planes that attacked five enemy monoplaces and three biplaces. He and another member of the patrol brought down one enemy plane and the three dived

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Patenting Your Inventions

by J. D. VAN VLIET

Just what a patent means to the inventor, how it is obtained and the many complexities that attend the procurement of a patent. A good, informative, practical article for would-be inventors.

IF the average inventor should be asked just how much he knows about his own patent, the question would very likely evoke either surprise or resentment.

The reply would probably be to the effect that inasmuch as the inventor has expended much time and effort on perfecting his device, and since moreover, the United States Patent Office has deemed his invention good enough to grant a patent on, the questioner may rest assured that the inventor knows perfectly well what it is all about.

This reply, a very usual one by the way, may be terse, but it is not convincing. In fact, it begs the question.

We refrain from arguing the point, and instead venture to present the case of a hypothetical inventor, whom we shall call Mr. Smith. For the sake of illustration, it will be necessary to introduce into Mr. Smith's experience rather more calamities than ordinarily fall to the lot of an inventor in pursuit of a patent.

Being endowed with a constructive type of mind, our Mr. Smith conceives an idea and careful consideration fosters the belief that this idea is practicable and feasible; moreover, having never seen anything like it, Mr. Smith has reason to believe that his idea is novel and original as well: an invention, in fact.

So, Mr. Smith goes to work and spends many laborious hours and much hard cash in giving a tangible form to his invention. After wrestling with many rather unexpected snags and bugs, a device is finally contrived which, although somewhat different to the original conception, performs fairly satisfactorily. In other words, Mr. Smith has reduced his invention to practice.

The next logical step, to Mr. Smith's mind, is to apply for a patent, and the services of a reliable patent attorney are accordingly secured.

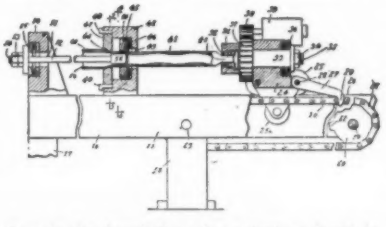
The attorney inspects such data and sketches as Mr. Smith is able to furnish, and even has a look at the device itself. Yet, regardless of Mr. Smith's enthusiastic assurance of the incontrovertible originality of the invention, he decides to have a preliminary search made of prior patents relating to the same subject, and in due course a number of copies of such patents are forwarded to him by his agent.

These patents show devices of a nature akin to that of Mr. Smith's device, some of them are slightly different, while others are markedly divergent in their essential features. In all cases, the difference is sufficiently obvious to warrant further efforts, and Mr. Smith, although somewhat taken aback by the copious results of the search, instructs his attorney to go ahead with the patent-application.

A number of patent drawings are made illustrating the valient features of the device with special reference to its supposed improvement over other devices; a specification is written explaining the drawings and describing in detail the nature and functions of the presumably novel features, and a set of claims is drawn up defining those features which the applicant particularly claims as his invention.

The completed application comprising the petition, the oath, the drawings, the specification and claims, and the filing fee of thirty dollars, is mailed to

PROPELLER TOOL, No. 1,967,487
Horace L. Waisner, Rockford, Ill., assignor to Mechanics Universal Joint Company, Rockford, Ill. Issued July 24, 1934. 39 claims.



Here is the description of a patent as found in the Patent Office Record, printed after the patent is granted.

the Patent Office. The Patent Office's return slip acknowledges the filing fee and gives the filing date, the number of the application and the examiner's department to which the application has been provisionally assigned.

Mr. Smith can now say that his patent is "applied for." Being of a sanguine disposition and unacquainted with Patent Office procedure, he very likely considers his patent as good as granted, the rest being merely a matter of formalities and red tape. In this optimistic view, however, he may well be mistaken, and he has yet to learn that the familiar legend "Patent applied for" means very little indeed.

After an interval of several months, Smith's case finally passes to the examiner. The delay, although irksome, was unavoidable and due to the fact that several hundreds of applications were still awaiting examination at the time Smith's application was filed. Considering that the Patent Office receives from 1,500 to 2,000 applications every week in the year, it is not surprising that some departments which are particularly crowded, are far behind schedule.

The patent-examiner checks Smith's application and analyzes the specification and claims as to diction and subject matter with special reference to the "prior art." The prior art not only comprises everything that has been done and patented in this country along the lines the inventor has worked on, but it also includes everything patented along those lines in foreign countries.

The examiner's first report on the case is called "First Office Action" and is at once mailed to the attorney who notes the objections and the references cited. This report puts him in a position to make a thorough study of the case and to shape its prosecution to the best advantage of his client. As a rule the attorney does not accept the examiner's first decision as final; he prepares his arguments, cancels some claims, substitutes or adds new claims, amends other claims so that they do not read on prior disclosures, and if necessary, he may even amend the specification as to diction and general arrangement. He is not allowed, however, to introduce new matter.

The attorney's reply to the examiner's action is called the "first amendment" and opens the "prosecution" of the case. The word "prosecution" has an ominous sound, but it merely means the exchange of objections and arguments between the examiner and the attorney. In a hard-fought case this process may have to be repeated a number of times, the examiner advancing new objections and references against the attorney's amendments.

It should be noted that the Patent Office will give the applicant just what he is entitled to in view of the prior art, provided he takes the trouble to claim it. The office, however, will make no effort to point out or correct any omission or negligence on the part of the inventor or his attorney.

If both sides stand pat on a certain point, the attorney can appeal to the Examiner in Chief; should he be dissatisfied with that functionary's decision, he can appeal to the Commissioner of Patents himself as a last resort. The Commissioner's decision is final.

Simple applications will be comparatively quickly disposed of; in the more involved cases the prosecution may extend over several years and during that period the inventor does not know exactly where he stands with reference to the prior art. Should he actually start to manufacture his de-

vice during that period, he will be taking a big chance.

Mr. Smith's patent is finally allowed. Although he has six months in which to pay the final fee, he prefers to settle this matter right away, and immediately upon receipt of this fee of thirty dollars the patent is prepared for issue. A week or two later Smith finds himself in possession of his patent which accords him the sole rights to his invention for a period of seventeen years from the date of issue, within the confines of the United States, its territories and dependencies.

Mr. Smith is elated. He has actually got his patent and his invention is duly "protected," witness the Government Seal and red ribbons. The patent shows a good picture of his invention and gives a comprehensive description of its operation. It also includes some claims which are most likely a concession to certain formalities insisted upon by the Patent Office. Evidently his invention must be a good one, or else the United States Patent Office would not have granted a patent on it. All of which sounds very good.

In a confident mood he takes his patent to a manufacturer producing devices of that description, and if this party knows what is good for him he will be eager to make a deal with Smith. The party in question appears to be languidly interested. He casts a critical glance at the drawings, rather skips the specifications, and takes his time reading the claims.

At length he announces that Mr. Smith may possibly have something there, but before a definite opinion could be arrived at it would be necessary to investigate the "file history" of the case, that is to say, the entire record of the application and its prosecution. Mr. Smith argues that his invention works perfectly and is patented, but is informed that this is beside the point, which rather puzzles him.

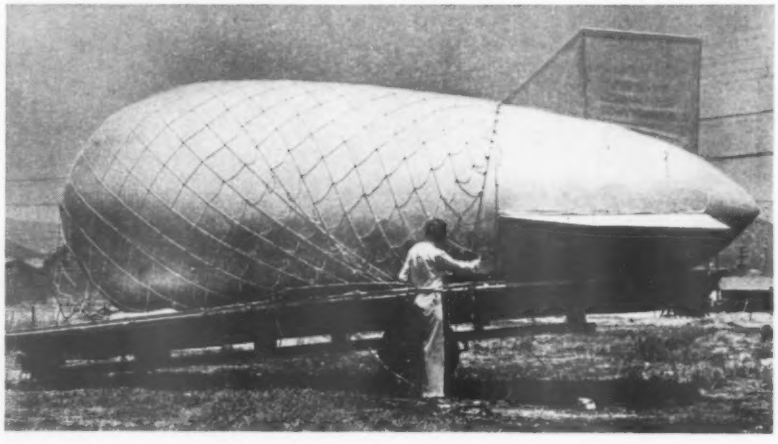
At their next meeting the manufacturer submits the result of his investigation. It appears that:

1. At first office action several claims were rejected on prior patents describing substantially the same combination of elements claimed by Mr. Smith. Some of the patents cited date so far back as to have actually expired. This signifies that part of the "invention" is old and has long since been public property.

2. Two claims read on two different European patents not included in the attorney's preliminary search which was confined to American patents only. Since these two European inventors did not take out patents for their inventions in the United States, Mr. Smith could safely manufacture and market his device which apparently contains some features claimed by the European inventors, within the borders of the United States. But for that matter, so could anybody else, since the United States Patent Office did not allow Mr. Smith's claims in

(Concluded on page 320)

This Baby Blimp Tows Banners for a Living



Here is the baby blimp mounted on its trailer ready for transport. It is about the smallest thing that we have seen along this line.

THERE have been baby airplanes by the score, in fact one of the smallest racing planes is shown in this issue, but baby blimps have been few and far between.

It was built by V. A. Noble, Hollywood, Calif., who employes it for trailing advertising banners and similar work. It is 25 feet long and 10 feet in diameter at the largest point. Instead of using the envelope for carrying the load, as in the case of large non-rigid airships, a net is used similar to the nets employed with balloons.

While home built airplanes are a possibility and an actuality, in fact, the home built blimp is a more difficult proposition for the amateur to handle. Furthermore, it is far more expensive to operate and cumbersome to control.

The Tailless Plane is Making Progress

AFTER many years of experimentation with the old tailless ship known as the "Pterydactyl," the British inventor has finally been awarded with success and has had the satisfaction of giving a satisfactory demonstration for the British Air Force. It is said that the operation of the ship is everything that can be desired.

As will be noted from the photograph, the machine is of the tractor type which is unusual with this sort of plane. However, the lack of the propeller and tail-group in the rear gives a larger field of fire to the machine gunner in the rear cockpit.

The English tailless plane in flight during trials before the military authorities. Unlike most tailless planes, it is of the tractor type.

The Story of the Douglas D.C.'s

by LAWTON TINSLEY

A story of how a giant airliner is designed, built and tested. Beginning with simply an idea, the work is carried through the wind-tunnel tests, a "mock-up" is made and then the design is actually started. Then come the shop operations and the final test flights.

FLASHING across the continent in the amazing time of thirteen hours and two minutes, the Douglas Transport literally hurled itself to the front in the annals of Commercial Aviation history.

At a rate of speed excelled only by highly sensitive speed planes, the D.C.I., carrying its designed load of twelve passengers and over fifteen hundred pounds of cargo, established a new transcontinental transport record and set a mark for transport manufacturers to shoot at in the years to come.

That rival manufacturers are not losing any time in speeding up their ships is exemplified by the recent great change in aerodynamic style on all types of planes, both military and commercial. The deep fuselage-to-wing-fillets and the exceptionally clean areodynamic designs, characteristic of the Douglas which are coming out on all the new ships, lead one to wonder how long the present record will stand.

The true top speed of the Douglas Transport is known by very few people and they refuse to talk. Under such circumstances it is impossible to make a near-accurate estimate of the cruising speed. However, it is safe to assume that the ship is much faster than the published reports would lead one to believe.

To substantiate this assumption, it is said that the ship was not extended on the record breaking run and that when it is necessary, the record can be further reduced. This tends to make the record breaking future of passenger planes a little more complicated but a great deal more interesting to watch.

Anthony Fokker, when purchasing the rights to manufacture the Douglas Transport in Europe, is credited with saying that it would be useless for him to spend time and money in an effort to build a ship capable of favorably competing with the Douglas due to the time element involved in tests and experiments and the uncertainty of results.

It may be true that the transport startled the world because of its tremendous speed, but a study of its development from an idea to a record breaker will prove that it wasn't designed for speed alone.

The "idea," in the form of a one-eleventh scale model of the transport, was taken to the 200 m.p.h. tunnel at the California Institute of Technology where an extensive series of tests (approximately 200 test-runs) were made.

Every item of the plane affecting aerodynamic operation was considered in the wind-tunnel. The investigation

A Douglas D.C. passenger transport belonging to the Transcontinental and Western Air. When in flight, the landing-gear is retracted into the interior of the ship.

covered tests on three complete wings, wing-to-fuselage-fillets of which a number were tested before the correct contour was determined, and tests on numerous combinations of tail surfaces, ailerons and wing flaps.

Tests of controllability and stability were made with different sets of control surfaces, both fixed and free. This was probably the first time that a model was allowed to demonstrate its ability to fly "hands off." The high speed of the tests and the large scale of the model were invaluable in perfecting the final areodynamic design.

A particularly interesting fact is that some of the early models tested were unstable and that it was necessary for satisfactory stability to incorporate a new arrangement of center-of-gravity, wing sweepback and general external appearance. The actual plane was built according to this heretofore untried plan of arrangement and its performance in flight carried out the predictions of the wind-tunnel tests.

Something of the value of these wind-tunnel tests may be gathered from the fact that the transport is so clean, areodynamically speaking, that the total resistance of the complete plane is less than twice the resistance of the wing alone.

Upon completion of the wind-tunnel tests a full scale model, called a "mock-up," was built to determine the location and the proportion of all structural details. The external design or streamline form of the mock-up was drawn up from the results of the wind-tunnel tests. The model itself was made with wooden frames and was covered with stiff paper to represent the metal skin of the actual plane.

The interior arrangement of the cabin was worked out to the smallest detail in the mock-up. The cabin floor was installed completely above the wing, thereby doing away with structural members within the cabin. The arrangement of passenger chairs placed each chair opposite a window, gave ample leg room, wide and unobstructed aisles and allowed a passenger over six feet tall to walk erect in the cabin.

Different materials for the interior cabin trim were tried, including various wall coverings, curtains, floor covering and chair upholstery, until a neat, light, durable and easily maintained set-up was determined.

After much consideration, the final location of the lavatory and rear baggage compartment allows one to pass through the lavatory to the rear baggage compartment and into the tail portion of the fuselage where the radio apparatus is located, while the ship is in flight.

A great deal of effort was put into the development of the pilots' compartment. A complete system of controls, full size and in working order, was installed. The control handles and levers were placed in a great number of positions to determine their most practical arrangement. An instrument panel was built with full scale dummies of the instruments in place. A satisfactory allocation was made after numerous installations by means of which all related instruments were grouped together.

Light reflection and instrument board lighting were thoroughly investigated. Mirrors were first installed in the mock-up pilots' compartment in place of windshield glass. The angles of the mirrors were varied and their reflections noted until a setting was made which would not reflect light from the instrument board. A complete lighting system was then installed with actual windows in place and the results were checked at night. Ground light reflections were determined and eliminated by moving lights around the outside of the mock-up. The full scale

model was complete down to inspection openings to all control cables.

In addition to the mock-up, a number of full scale working set-ups were built for test purposes. A complete fuel system was built with all lines and fittings of actual size and length. An accurate measurement of fuel flow and output was then obtained by driving the fuel pump with an electric motor.

The hydraulic-retracting mechanism for the landing-gear and wing-flaps, complete with cylinders, oil lines and controls, was reproduced to determine the arrangement of the component parts. The hydraulic-brake system was built up complete to the pedals, enabling an accurate measurement of the oil line pressure at the wheel with various pedal pressures.

To avoid the possibility of tail-wheel shimmy, the tail-wheel was mounted below a frame carrying a weight box to which different loads were applied and the complete apparatus was towed behind a truck at varying speeds. From these experiments the best trail and castor dimensions of the tail-wheel were determined and shimmy was eliminated. With the location and proportion of the structural details completed from the mock-up, the design for structural members of the actual plane was begun.

It was necessary to construct a wing having small unsupported surfaces and with the material so distributed that there would be no great stress variation in the component parts. At the same time, the wing must have negligible torsional deflection and a minimum of vertical deflection. In selecting the wing construction for the transport, single, two, three and multi-spar designs were considered as well as the shell type and multi-cellular designs.

The Northrup multi-cellular wing construction was finally chosen, due a great deal to its success on the "Alpha" mail carrying model, which has been operating for several years, each plane averaging over 5,000 hours in the air with no structural overhaul required.

This type of construction consists of a flat skin reinforced by numerous longitudinals and ribs. The combination of flat skin and full length stringers takes care of the bending while the shear loads are carried by three main webs. Indirect stress is carried by the skin with frequent ribs preserving the contour of the wing. This combination of webs, ribs and skin divides the entire wing up into a number of small rigid boxes or "cells," from which this type of construction derives its name.

The completed wing is extremely light for its strength and rigidity, is easily constructed and kept in repair. Since the major loads are carried in the outer surface of the wing, as well as in the internal structure, an inspection of the exterior gives a ready indication of the structural condition.

The problem in fuselage construction was basically the same. The ex-

(Continued on page 326)

The Ryan S-T Monoplane is a New Departure

(See front cover drawing)

Side elevation showing the clean lithe lines of the new Ryan S-T monoplane. It is designed for the use of the private flyer.

THE RYAN low-wing monoplane, known as Model S-T, is a two-seater intended primarily for the use of the private owner and sportsman flyer.

It is highly efficient, the mark of 18 miles per gallon of gasoline is said to be attained at cruising speed, a fuel consumption rivaled by few automobiles. It is provided with the Menasco Pirate engine as standard equipment, installed in the inverted position. Either the Menasco B4-95 h.p. engine or the C4-125 h.p. engine is approved by the Bureau of Air Commerce.

The construction of the Ryan S-T is largely of metal. The fuselage is built up in true monocoque form with plates of Alclad 17 ST alloy, riveted as sturdily as a tank. The wing spars, of spruce, are the only wood parts in the ship. Both the wing and tail are duralumin structures, fabric covered.

Wing flaps (air brakes) are standard equipment, and are said to reduce the normal landing speed by 10 m.p.h. Tab trimming control, controlled from the cockpit, makes it possible to employ a fixed stabilizer, and in addition, the tabs make more accurate adjustment possible.

Long stroke oleo hydraulic shock-absorbers are used on the landing-gear, which with full airwheels makes landing soft and feathery, even on rough ground. The tail wheel is also provided with a shock-absorber which reduces stresses on the machine.

The "Tilbury Flash" is Smallest Racing Plane

THE TILBURY FLASH was by far the smallest racing plane at the Cleveland races. So far as size goes, it is the realization of the amateur's dreams. However, from a practical standpoint, such extremely small planes have disadvantages all their own for the amateur flyer and are not recommended for such purposes, although they may look "cute."

Its low monoplane wing is hardly more than ten feet in span, with a length that is less than the span. Its principal drawback is its extremely small landing wheels which can be used only on the smoothest of runways. During its flights, it was piloted by Clarence MacArthur, shown seated in cockpit. Mr. Tilbury, the constructor, is shown standing beside his creation.

Here's the "Tilbury Flash," one of the smallest planes to enter a real race. It was piloted at the Cleveland races by Clarence MacArthur.

Yankee Aircraft in the Big Race

by MAX KARANT

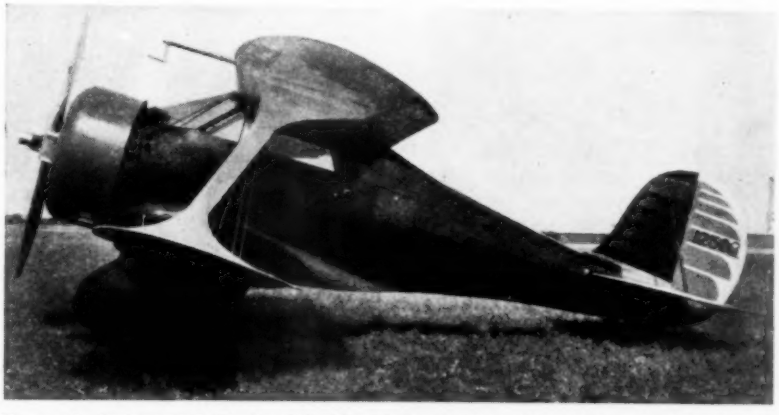
If we are to judge from the number of American airplanes entered in the MacRobertson race, on an average probability basis, then the United States stands a good chance of winning one of the world's greatest contests. And some of the Yankee planes are plenty fast.

ENGLAND to Australia—as gruelling and exacting a hop as has ever been attempted by any aircraft—is the route that over sixty airplanes, ranging from small sportplanes to giant high-speed transports, will take in the latter part of October, when they vie for first honors in the international MacRobertson race.

An astonishing fact is that, of the sixty-odd machines entered in the flight, over twenty are American-built—many of them being flown by Americans, several by foreign pilots. All these ships of American origin have had very little altering or "souping up."

No greater tribute could be paid American aeronautical engineers than was when a number of foreign aircraft companies and pilots—all of them with access to the best flying equipment in their home countries—placed their orders for *standard* American airplanes and announced that they would fly these ships against all the special long distance racers that have been built by several European contestants. Lockheed and Douglas are the American favorites. Wiley Post has entered his "Winnie Mae," a three-year-old Lockheed Vega, and has altered his ship only to install a supercharger and extra tanks.

Finishing touches are being put on an Orion at the Lockheed factory at Burbank, Cal., which will be flown by Laura Ingalls, while Ruth Nichols is planning to race a Lockheed Altair. Foreign pilots who will fly Lockheeds are Sir Charles-Kingsford Smith, the Australian ace, who has just taken delivery on his Altair, the "Anzac"; James Woods, prominent English sportsman-pilot, who will fly the late Lieut.-Comdr. Glen Kidston's three-year-old Vega; and Michal Detroyat, French ace, who purchased a standard Orion last year and will install a Hispano-Suiza 9V radial engine for the race. Walter Varney, veteran U.S. airline owner and operator, has entered one of his Orions which he now uses as standard equipment on his Mexico-United States line, Lineas Aeras Occidentales. He has replaced the seats with fuel tanks, repainted it and named it "West Wind."



The speedy single-engined "Beechcraft" with a Cyclone engine, which will be entered in the race by Mrs. Louise Thaden.

According to his announced plans, Harold Gatty, of the famous Post-Gatty round-the-world team, will fly a standard Douglas DC-2 in the event. Another DC-2, the standard Douglas airliner now in use on several American airlines, has been entered by the Dutch airline, K.L.M., and will be flown by two of that line's crack pilots, K. D. Parmentier and J. J. Moll.

It was first thought that Col. Roscoe Turner would also fly a Douglas but he and Clyde Pangborn recently announced that they had altered their plans and have now teamed up to fly a Boeing 247D airliner, identical with the ships now in use on United Air Lines. Pangborn had earlier announced his intentions of piloting a special Gee Bee in the race.

Capt. George R. Pond and C. Sabelli, who recently flew their Bellanca Pacemaker across the Atlantic to Ireland, had announced their definite entrance in the race and planned to use their Bellanca but, just recently, the machine was damaged quite seriously while making a forced landing in Ireland. However, Bellanca will probably be represented as Lieut. J. C. Fitzmaurice, Irish ace of trans-Atlantic fame, intends flying a special low-winged Bellanca that is now nearing completion at the factory.

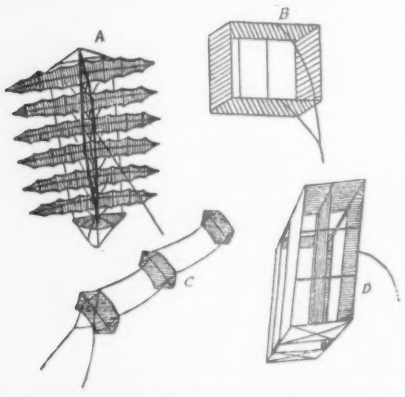
John H. "Jack" Wright, prominent American sportsman-pilot, has placed his entry for the MacRobertson race with the officials and will fly a high-speed Monocoupe powered with a Warner Super-Scarab engine.

Murray B. Dilley is also planning to be in the dash flying a Vance flying wing monoplane powered by a Pratt and Whitney Wasp. Roy W. Ammel, another American flyer, entered a General Aviation GA-38 tri-motored monoplane but it has since been found that

(Concluded on page 323)

Walter Varney, the veteran American airline operator, will enter one of his Lockheed Orions, standard equipment on his airlines.

Development of the Kite



Early kite forms: (A) The nikel kite, (B) The slat kite, (C) A train of Baden-Powell kites of the man-lifting type, (D) The Marvin Weather Bureau kite.

DURING the past few years, little has been done with kites, either experimentally or practically. It is strange that this important part of aeronautics should have been so neglected because the kite has a definite place in the scheme of things.

Dating back from early Chinese history, the reaction of the wind upon inclined surfaces has always held a fascination for men. The sailing of a kite up in the blue naturally suggested flight and from the earliest days, various types of man-carrying kites have been attempted, some successful and some that were not. The triumph of free flight by the Wright Brothers can be briefly described as the substitution of an engine driven propeller for taking place of the kite string.

Modern kites begin with the experiments of Douglas Archibald in 1883 who conducted experiments with kites for carrying meteorological instruments into the air. He was only partially successful, however, and it was not until 1894 that the first automatic recording apparatus was sent up at the Blue Hill Observatory, Mass. In 1898, Prof. Marvin, Washington, D. C., arranged seventeen kite stations for the U. S. Weather Bureau. In the same year, Major Baden-Powell, England, raised men by trains of kites, followed by Lieut. Wise in the United States. Samuel Cody, an American in the British Balloon Department, Aldershot, raised men to a height of over 3,000 feet with a kite.

During all this time, various forms of kites have been tried out with varying results. The hexagonal or quadralateral kites now used by children as a toy have little stability and a very small angle of ascent. However, the hexagonal type as used by Baden-Powell gives excellent results when used in tandem or series arrangement. As will be seen, the Baden-Powell type is tailless.

The nikel kite takes the general form of a multi-wing airplane with the wings arranged in tandem along a central fuselage. Then, we have the slat type with the surfaces in the form of slats arranged in box form. The Marvin kite consists of two bottomless boxes in tandem with a central fin for stability.

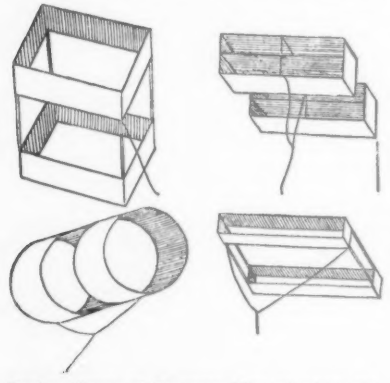
But, of all the kites, the Hargrave or box-kite has displaced all others. It consists of two or more box-like cells having the lifting surfaces inclined at different angles for the sake of stability. Well built Hargrave kites weigh about 1.33 pound per 10 square feet of lifting surface and require a wind velocity of about 12 m.p.h. for soaring. The lifting surface is the cell fronting the wind. It will rise steeply, along an angle of 60 to 67 degrees with the horizontal.

As shown in the accompanying illustration, there are a number of different shaped cells or boxes used with the Hargrave kite: The flat box type with the surfaces normal to the wind; the box type with an intermediate partition running horizontally across the inside of the boxes; the cylindrical box type and the square box with the corners entering the wind. The latter is probably the most stable because of the dihedral effect of the cornerwise surfaces.

The "slat" type requires only 75 percent of the wind velocity necessary for the Hargrave kite and at the same time is simpler and less likely to be broken, but it is far from being as stable as the Hargrave. The slat type will rise easily with a wind of 12 m.p.h.

A superficial area of 180 to 250 square feet is the greatest area that a single kite can conveniently possess. If more lifting effect is required than can be obtained with this amount of surface, then the additional area should be divided up among a number of kites in tandem form. A team of kites pulls more steadily than a single kite. It is estimated, on the average, that 12 feet square—144 square feet—has a lifting power of about 140 pounds.

Kites having the surfaces of airfoil form are even more efficient than those described here—so far as lifting effect is concerned.



Various forms of Hargrave kites of which the kite in the upper left-hand corner is probably the best.

Science Kills Fog

GREAT news for the aviator is the report that science has succeeded in killing fog—the worst enemy of flying.

Squirting a secret liquid chemical into a rolling fog, which had enveloped an airport near South Dartmouth, Mass.. experimenters from the Massachusetts Institute of Technology caused the fog to turn into rain.

This new victory in the conquest of fog occurred on the Round Hills estate of Col. E. H. R. Green, where the institute has been studying fogs for more than five years. It climaxed a long series of experimentation. Scientists who witnessed the demonstration were enthusiastic in the belief that the way had now been opened for the possible use of fog dissipation to clear landing ground for aviators.

These experiments, directed by Henry G. Houghton, Jr., of the Institute's research staff, recall similarly successful fog-condensing efforts made several years ago. At that time. airplanes, circling above Bolling Field, Washington, D. C., scattered heavy clouds by discharging into them a steady stream of electrified sand—an experiment superintended by Prof. E. L. Chaffee. assistant professor of physics at Harvard University.

A like test was conducted by Army flyers at McCook field, near Dayton, O., in the presence of aerial experts, including Wilbur Wright, but meteorologists declined to accept the partial success of the experiment as proof that fog could be dispelled or converted into rain by artificial means. Following these demonstrations, Prof. Chaffee expressed himself as confident that a way had been discovered to break up clouds and even to produce rain under certain conditions.

"It is a common experience," he said, "to observe low-hanging clouds with the promise of rain at any moment. But often a wind bears these clouds away. In that particular opportunity, the aerial service of the future may take to the air and send down volleys of charged sand dissolving the formations and causing rain.

"In some of the experiments to date rain has resulted in a limited degree. In others, the clouds have not been large enough, or the drops were too small for the rain to develop. No general fall of water has so far resulted."

That airplanes may prove useful in rain-making suggests a new use for an aerial army. Who knows but what we may have our fleets of "rain-makers" in the future?

In Our Next Issue

EVERYONE in aviation is directly concerned with the regulations issued by the Bureau of Air Commerce and its director, Eugene Vidal. It is for this reason that we are publishing an interesting biography of Mr. Vidal, in the December issue, that has been prepared specially at our request.

The Giant "Maxim Gorki" ANT-20

by FAY GILLIS

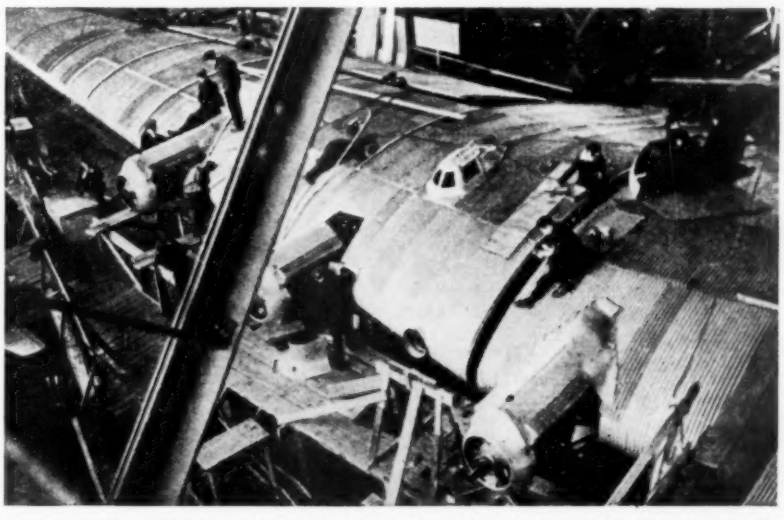
Miss Gillis, who is now a resident in Russia, writes a comprehensive description of the giant airliner "Maxim Gorki," built by Soviet Russia for distributing propaganda. Carries a printing plant and motion picture show.

SOVIET Russia's major contribution to the advancement of international aviation this year, is the world's largest landplane, the ANT-20, which made its flying debut on June 19, when it dipped its wings above Red Square in salute to the seven flying heroes who rescued the members of the Chelyuskin.

This forty-two-ton, all-metal monoplane, named in honor of Maxim Gorki, famed champion of the proletariats, has a wing spread of approximately 200 feet and a fuselage 109 feet long. The wheels are 6½ feet in diameter and its rudder is larger than the wing of an ordinary plane. It is powered with eight motors, developing 7,000 horsepower. Six of the motors are set along the leading edge of the wing and the other two are arranged in tandem above the fuselage. It has a cruising speed of 136 m.p.h. and a maximum speed of 148 m.p.h. The normal cruising range of the world's largest airplane is 620 miles, but there are reserve fuel tanks for an additional 620 miles.

Besides its printing press, complete equipment for the taking and developing of sound film, its electrical station capable of supplying enough power to light two hundred houses, its searchlight of 2,800,000 candlepower and the first automatic telephone system ever installed in an airplane, it has accommodations for the twenty-three members of its crew and forty-three passengers.

This latest Soviet claim to the possession of the "world's largest things" is to be used mainly for agitating-propaganda work. As the flagship of the Maxim Gorki Agit-Squadron, consisting of twenty-eight planes, it will fly to the remotest parts of the Soviet Union, spreading the gospel of Lenin and aviation.



Working on the gigantic wings of the "Maxim Gorki," a picture that shows the proportions graphically. Note that the wings are covered with corrugated metal instead of the flat sheets employed in the U. S. A.

Last year, the Maxim Gorki Agit-Squadron, without the aid of their flagship, made 4,500 flights in 3,710 hours, covering a distance of 246,179 miles. They carried 15,053 people who were awarded flights with the fleet as premiums for their good work. In addition, they held 2,000 meetings in 1,500 different places and distributed 8,800 pounds of propaganda. With the new giant of the air, which was designed especially for this type of work, they will easily surpass their record for 1933.

One of the main features of the Maxim Gorki is its rotary printing press. The total weight of the press together with its motor is only 550 pounds. While the plane is in flight, the hourly output of the press is 8,000 leaflets printed on both sides. In connection with the press is a photo-developing room, where pictures, made in flight, are developed and used in the leaflets printed in the plane.

But the most interesting innovation in this colossal airplane is the automatic switchboard for sixteen telephones. This is the first time that such a system has been installed in an airplane. It works by a series of light and sound signals and is used mainly for communication between the commander and his crew, but there are also telephones in the passengers' quarters.

There are three radio operators to handle the radio work of the ANT-20. Telegrams may be sent directly from the plane for a radius of 1,400 miles. Along with their routine work, they have to keep the broadcasting set (another feature of the propaganda plane), in condition. It is claimed that the loudspeaker can be heard on the ground from a height of half a mile. When it is inadvisable to land the

A Russian postcard with a portrait of A. N. Topolov, the designer of the Maxim Gorki, together with size comparison photos of his first ships and the ANT-20.

Maxim Gorki in remote places, it can circle over the spot, broadcast its message, drop the pamphlets which were printed in the plane, and fly back to headquarters, having completed its work without running the risk of damaging the plane in landing.

But in spite of the fact that this giant is principally a propaganda plane, it has accommodations for 43 passengers whose every comfort seems to have been thought of. In addition to the usual conveniences found in airliners, the ANT-20 has a regular buffet where hot meals are served and for those who feel so inclined, there is a shower bath. In the passengers' compartment is to be found a library containing books of fiction as well as those of science and technical material.

The idea of the Maxim Gorki was first thought of by M. E. Koltsov, a well-known Soviet writer and publicist. He suggested the "flying printshop" in 1932, to commemorate the 40th anniversary of Maxim Gorki's literary career.

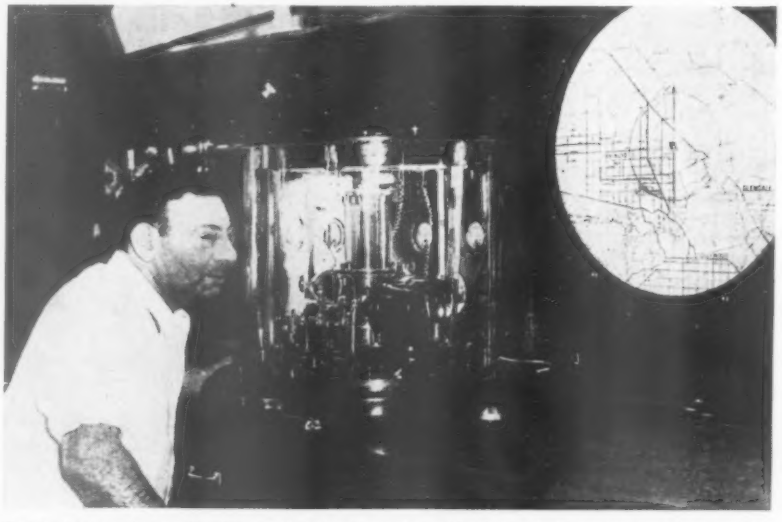
When the idea was first brought to the attention of Jurgaz (United Magazines and Papers) of which Koltsov is the Chairman, it was met with skepticism, but when put before the public through the newspapers it was an immediate success. An All-Union Maxim Gorki Agit-Squadron Committee was organized to collect the funds for the Maxim Gorki. In Leningrad, 1,000,000 rubles were collected from the workers during a campaign lasting only ten days. Gorki Province, the birthplace of Gorki, contributed 568,000 rubles. In all, a total of 6,000,000 rubles was subscribed to the building of the world's largest airpalne.

No less a person than A. N. Tupolov was assigned to design the ANT-20. Ten years ago the first plane of the ANT series (named after Tupolov's initials) was constructed. It was a small monoplane with a wing spread of only 23 feet. Since then Tupolov has designed several famous airplanes. The best known in America is the ANT-9, called the "Land of the Soviet," which flew to America in 1929. Until the ANT-20 made her debut, his 37-passenger ANT-14 was the largest landplane in the world.

The proletarians are most proud of the Maxim Gorki, which was built at Tsagi (Central Aero-Hydrodynamic Institute) exclusively of Soviet material, by Soviet workmen, with Soviet money. One hundred and twenty shops from all over Russia have contributed to the building of the plane and the ship is the pride of Soviet Russia where everything that is big is important.

More than 50 trucks, working five nights from midnight until six in the morning, were required to move the parts of the ANT-20 to the flying field. The plane was then assembled and took its maiden flight without delay. Tovarish M. M. Gromov has been honored by being appointed pilot of the new craft. The crew is picked for its knowledge of flying and is also an honorary job.

Perfecting a Flight Recorder



This is the complex mechanism of the flight recorder with the projection at the right in circle.

WHILE much effort has been put forth in recent years toward the development of navigational instruments by which a plane can guide itself through fogs and clouds, little attention has been payed to the reverse process of picking up a plane from the ground and tracing its course in flight.

It is obvious, that any instrument located at a ground station capable of indicating the exact position of any plane at any time, would be of great value to a commercial operator. He could check up on the pilot's estimate in weather of poor visibility and perhaps advise the pilot as to his course. Again, it would make it possible for the operating department to locate a crash or forced landing in cases where the radio conked out.

Therefore, we learn with great interest of the experiments now being carried out on an airplane flight recorder, by Dr. Samuel Spitz, former lieutenant-commander in the U. S. Navy. This device actually traces the flight path on the map as indicated in the photograph and is exceedingly valuable for tracing and locating crashed ships. A beam of light from the apparatus shown on the bench is the indicator, and the location of the beam on the map is the ship's position.

On the theory that every propeller emits a different sound of different pitch, Dr. Spitz has developed an apparatus that transforms the propeller sound into vibrating light, and from these light vibrations he transmits the position. Not much is known of the theoretical side of the system but it is said that the scheme works well.

Dr. Spitz is also the inventor of the sonic depth finder for ships and is an expert in sound.

Grey Lauds American Airmail System

ACCORDING to C. G. Grey, editor of *The Aeroplane*, leading British aviation publication, "The airmail service of the United States has been the envy of the world." "No other country," writes Mr. Grey, "can show as high a standard of speed, regularity and safety combined or such perfect ground organization. Our Imperial Airways can compete with America on safety and regularity, but does not pretend to compete on speed, ground organization or equipment."

A comparison of schedules published by American and British airlines reveals that the average cruising speed of British and European commercial aircraft ranges as high as 130 miles an hour, while in the United States the new schedule of the TWA Douglas, which recently went into scheduled service between Pittsburgh and New York, is based on a cruising speed of 180 miles an hour.

In his editorial, Mr. Grey continues: "We in this country await with interest the outcome of the airmail controversy in the United States. The craze for competitive bidding from which all government departments seem to suffer, may lead and has led, to all kinds of evils. Cut-throat competition would mean cheaper planes, poor equipment on the ground and many lost mails and passengers. Government contracts must be awarded on merit and not on price if a country is to get the best value for its money. And the people who had the American mail contracts were better fitted to have them than anybody else, by reason of their experience in the design, construction and operation of their planes."

High-Lights and Side-Lights

by STEVE O'CONNOR

A little chit-chat, here and there, about the great and near great in aviation.

WELL, children, the National Air Races once again are history . . . brilliant history, you may be sure, but splotched with the blood of one of the finest pilots that ever pancaked into a cornfield . . . good old Doug Davis of Atlanta . . . and here I pause a moment in silent tribute to one grand guy . . . and may there be nine hells waiting for the ghouls who fought over his battered body to tear off pieces of the shattered plane for souvenirs . . . There must, in the very nature of things, be a particularly hot type of hell-fire for that breed.

That great big, beautiful bird, Aviation, will look like a sick crow when Uncle Sam gets through with him . . . I had just about made up my mind not to make that trip anyhow.

Yes, the Nationals this year were brilliant . . . plus . . . for ten days of activities were compressed into four . . . with resultant great benefit to the show as a colorful spectacle . . . Great Army, Navy and Marine Corps participated this year . . . the First Pursuit Group from Selfridge Field . . . Captain Claire Chennault's "Men on the Flying Trapeze" from Maxwell Field . . . the Navy and Marines from Quantico . . . and Ross Rowell, the hard-boiled leatherneck commandant, is plenty of color for any man's show . . . You know, of course, that he is a DSC for his valor in the Nicaraguan campaign against Sandino.

And the usual group of loyal workers to put over the show . . . "Riley" Colglazier on the money-boxes . . . Joe Helget with the tickets . . . Lyman Johnson doing his usual jam-up promotional job . . . Captain Julian Inglefield, Royal Flying Corps pilot in the days when the RFC was not the more civilized Royal Air Forces . . . in the RFC days those boys were pilots . . . pilots!

Amber colored course lights are being installed on some of the Department of Commerce rotating airways beacon lights throughout the country to inform airmen of the presence of airports which do not have lighting equipment continuously available for night operations . . . So, from now on, when you see that amber light you will know there is no one there to turn on the lights for your unheralded arrival.

Did you know that Lieut. Commander Settle, the stratosphere explorer, is the only man in the world licensed to fly anything that will fly? . . . Capt. O. P. Jones, one of the veteran pilots of Imperial Airways, has now spent 10,000 hours in the air . . . That is one year at the controls of all type airplanes . . . He has flown more than a 1,000,000 miles, crossed the channel 4,500 times and has carried more than 65,000 passengers . . . Nice record.

Thomas A. Morgan, president of Curtiss-Wright Corporation, announced that Theodore P. Wright, Vice President and General Manager of Curtiss Aeroplane and Motor Company of Buffalo, has been appointed Director of Engineering for the entire corporation . . . He was born in Galesburg, Illinois, on May 25th, 1895.

Went to the public schools and Lombard College and later attended the Massachusetts Institute of Technology . . . While there he enlisted in the Naval Reserve Flying Corps and was commissioned a Lieutenant in 1920 . . . He was then appointed an inspector of Naval Aircraft in Buffalo and later at the Garden City plants of Curtiss . . . After four years he resigned his Naval commission and joined the Curtiss company as Executive Engineer.

During his time as Chief Engineer planes which won the Pulitzer and Schneider Cup races were built . . . also many high performing military airplanes such as the Hawk, Falcon, Helldiver, Shrike, Raven, Sparrow Hawk, Goshawk and the Army Condor bombing plane . . . Commercial planes built under his guidance included the Robin, Fledgling, Kingbird, Carrier Pigeon and the Condor and the Tanager plane which won first prize in the Guggenheim Safe Aircraft competition.

Mr. Morgan also announced that Ralph S. Damon had been elected Vice President and appointed General Manager of Curtiss Aeroplane and Motor Company, at Buffalo . . . He remains as President of Curtiss-Wright Airplane Company of St. Louis . . . Damon was born on July 6th, in Franklin, Rhode Island, and attended the public schools there . . . took a preparatory course at Moses Brown Preparatory School in Providence, R. I.

He is also a graduate of Harvard University . . . He taught at the Massachusetts Institute of Technology until June, 1918, when he joined the Army Air Corps . . . He was one of the first pilots in the U. S. Army to carry mail on a regular route . . . He joined Curtiss in 1922 and after awhile was made Project Engineer, then Chief Inspector and finally Factory Superintendent . . . In 1928, with the increase of commercial sales, Mr. Damon was employed as Factory Manager of the Curtiss-Robertson Airplane Manufacturing Company at St. Louis.

There was a happy reunion when Flight Commander R. L. R. Atcherley landed in dear old Cleveland . . . but "Batchy" is a regular guy and don't you mistake it . . . no milksop can win the Schneider.

Phil Henderson wore his usual harried expression, as who wouldn't with three million and twenty-seven details on his mind? . . . Cliff was his usual well-dressed self . . . two outfits for days and another for evenings . . . and did he knock 'em for a row of Chicsales when be appeared in a belted coat of two-inch blue squares and trousers of mauve! . . . Boy, that was something to write back to Dubuque about.

You appreciate, of course, that there just couldn't be a show without "Doc" Kinkade . . . and Bob Dake . . . and Dick Fell . . . and Dudley Steele . . . and Carl Schory . . . and Jimmie Doolittle and Jimmie Haizlip . . . and Duke Jernegin . . . and Larry Guinther . . . and Doug Campbell . . . and "Gyro" Yancey . . . and, it is whispered, there was a great love-feast with Cliff Henderson and "Pop" Cleveland in the leading roles . . . You know there has been some friction there, although "Pop" was much in evidence with his ten-gallon hat and ten-inch stogie . . . Jack Berry was on the big end of a big job in keeping the port in shape for the races . . . Jack Berry is a grand guy, doing a bang-up good job with a really great airport . . . E. E. Elam of New Orleans came up to bring Abe Shushan's greetings from Louisiana's $5,000,000 lake front airport that the newspapers call a monument to Huey P. Long.

This year's show gave the pilots something new to go after . . . the Greve Trophy in the 550-inch class . . . Lanky Lee Miles, he of Ann Harding fame, took the trophy and broke the top off it before he got it downtown . . . Incidentally, Lee was the top money man in the smaller classes . . . Doug Davis, of course, took the Bendix before he crashed in the Thompson . . . "Oshkosh" Wittman did some fine flying . . . ditto Art Chester . . . ditto Roy Minor with his new "Miss Los Angeles" . . . ditto Harold Neumann and Gordon Israel . . . Ben Howard had a tough break when his new "Mister Mulligan" cracked up in Nevada . . . it was en route to participate in the Bendix . . . "twenty miles faster than Roscoe Turner's ship" . . . that's the way Ben puts it . . . Lee Gehlbach wasn't so hot with his new ship and was entirely out of the Bendix money . . . Vincent Bendix wanted some more action and, of course, has the necessary dinero to indulge in such whims . . . hence another $3,500 . . . this went to "Lion" Turner . . . The crowd was impressed with the

(Continued on page 331)

An Aviation Shrine in California

THE collection of insignia and badges pertaining to flying is an interesting feature of the St. Francis Chapel at the Mission Inn, Riverside, California. The chapel has been dedicated as an international shrine for aviators and is named in honor of St. Francis of Assisi, patron of birds and those who fly.

The collection is composed of winged insignia and badges worn by pilots in the various air-services of the world, both governmental and commercial, as well as designs used by manufacturers. In addition to the badges from the United States there are many from Europe, Asia, South Africa and South America. The collection is being made as a gesture of international friendship and many of the wings have been presented by foreign flyers as expressions of world friendship.

Over one of the cases of the collection is a painting almost uncanny in its fitness to its present use. It is of Spanish origin, painted on wood over two hundred and fifty years ago. The subject is St. Francis gazing into the heavens where a flying cross appears. The outline of the cross resembles an airplane to such an extent that it seems almost a prophecy of the role assumed by St. Francis in these modern times as patron of those who fly.

The 99's of Southern California recently paid an official visit to the shrine, to witness the placing of wings on the Famous Flyers' Wall by their vice president, Gladys O'Donnell. Miss O'Donnell's autographed wings are the first woman's insigne to honor the wall.

The shrine showing the cabinet of winged insignia and badges with the painting of St. Francis above the cabinet. Note the resemblance of the flying cross to an airplane.

The Aero-Sportswoman

by JOAN THOMAS

CLIFF HENDERSON must be a brave man! For he surely realized the storm that would develop when he prevented women flyers from taking part in any of the events at the National Air races.

It might have been only a mild squall, had he merely barred the girls from competing with the men in the high speed events, but he tempted the fury of the gods when he stood by his decision to keep them out entirely—even refusing to include the Aero Trophy race which has been the featured event for women flyers since 1928.

He didn't *say* they couldn't race—oh, no—he promised to schedule one providing there were at least six contestants. Then, after the girls had signed up, he calmly put the speed requirements so high that not a single ship entered could qualify! Subtle?

The 99, national organization of women pilots, protested bitterly, furiously, but to no avail. The organization's annual meeting, which is always held in connection with the National Air races, was smaller than usual because many of the girls who have participated in former years, did not feel it was worth while to make the trip if they were only to be allowed to decorate the grand stand.

However, those who came represented the massed opinion of the enraged feminists and they resolved to fight for the right to compete. A formal protest was filed with the National Aeronautical Association and a representative will be sent to present the case to the N. A. A. contest committee. A complete list of the records made by women flyers will be offered as proof that they have had their part in the development of racing. They do not insist on taking part in the men's races, but will demand the right to schedule women's events at the National meet.

The Women's National Aeronautical Association has called a special meeting of their Board of Directors and have jumped into the fight to assist the 99's, as they feel that this is a matter of vital importance to all women in aviation whether they are interested in racing or not. It is a Twentieth Century version of the age-old question of women's rights—shades of Susan B. Anthony and Emmeline Pankhurst. Mr. Henderson's autocratic ruling sounds dangerously like Herr Hitler's and Signore Mussolini's ideas on women's place being in the home.

As for the subject of racing itself, there have been fatal accidents at nearly every National Air meet, but the fact that two of those victims have been women does not prove Mr. Henderson's attitude that they should not be allowed to race because of the hazards involved. When the fabric ripped off the wing of Florence Klingsmith's ship, it was the opinion of many that "if she had kept her head and pulled-up, she could have bailed out." This year in a similar situation, Doug Davis did pull-up, but at 250 m.p.h. there isn't time to do much thinking whether the pilot is a man or a woman.

Placing the wings of the 99's on the wall of the Aviation Shrine, Riverside, Calif.

There is no doubt that high speed racing takes skill, courage and *sportsmanship*. We might think that men have had more training in the last named attribute when we hear that a contestant, when disqualified at the recent Women's Air meet in Dayton, is alleged to have said, "Well, if that is the way they feel about it, the next time I'll just cut the tail off of any ship that gets in my way, and it will be their hard luck." But we also remember that there were some pretty hard feelings over the Thompson Trophy race last year, so perhaps the odds are even on that score also.

Then, there is the old argument about the value of races. The fans and promoters still insist that the spectacular competition stimulates research and speeds the development of newer and better machines, but surely the money that is expended on prizes and for promoting these races might accomplish the same end in less dramatic ways and without its tragic toll of life.

The fact that Jimmie Doolittle was

(Concluded on page 337)

Landing 'em on a Carrier

by LIEUT. C. ADAIR, U. S. NAVY

The author shows how an airplane is landed on shipboard and the great precautions that are taken in getting the landing plane in just the proper attitude before it touches the deck of the carrier. Drawings by author.

LANDING Navy planes aboard the carriers is one of the most exacting procedures in Naval Aviation. The maximum in good judgment and of physical and mechanical efficiency is required in order that safe landings can be accomplished.

Of prime importance is wide-awake, well trained personnel in the cockpits and on the flight-deck, also perfectly serviced planes and flawless deck apparatus. The men behind the scenes in the shops where planes and other equipment are kept in first-class condition, should also be given credit as they are an integral part in the team play necessary.

The apparatus involved in the landing operation will have to be passed over in this discussion with the explanation that it is a Navy secret.

Of the personnel actually concerned with the bringing in or landing of the planes, the landing-officer is the "number-one" man. There are three such landing-officers on each of the four aircraft-carriers. In order that each might always be in the best of condition and alert while large numbers of landings are being made, they change off frequently.

A trio of landing-officers who have had noteworthy success is that group which was on duty on the U. S. S. Saratoga during recent fleet maneuvers engaged in the cruise from the West Coast to the East Coast. During these maneuvers over a thousand landings were accomplished without even a minor crack-up.

The landing-officer is stationed at the stern of the ship on the flight-deck to the right of the landing zone. He has a white signal flag in each hand which he uses to give signals to the pilot in the approaching plane as to distance, speed and altitude in relation to the deck. The various signals and their interpretations are given in the accompanying sketches.

The most successful landings are made by pilots who follow the signals entirely and who do not rely on their own judgment. The difficulties involved in a cross-wind landing are eliminated by the movement of the ship into the wind at a steady rate of speed. This movement of the ship also facilitates landings because it cuts down the ground-speed of the small fast planes on the deck.

The landing officer must first be an excellent pilot and second, must have exceptional ability in judging distance and speed. He must also be capable of making quick decisions in emergencies.

In order that the risk involved be a minimum in the training of the landing-officers and pilots for carrier landings, practice landings are made on a dummy deck marked off on a regular landing field. Each pilot is required to make at least twenty successful landings on this field before he attempts a carrier or ship landing. The landing-officer is required to bring in planes for several hundred successful field landings before he takes his post on deck.

The ever-present danger of emergencies arising makes the atmosphere on the flight deck tense and the faces of the men grave. The landing-officer

A trio of the landing-officers on the U.S.S. Saratoga. Note their insignia.

Here are the Flagging Signals

TOO FAST

The landing-officer warns the pilot that he is coming in too "hot" or fast. The pilot may have to make another try at it.

DO NOT LAND
(WAVE OFF SIGNAL)

Something has happened on board that makes it inadvisable for the pilot to land, and here is the signal for the plane to "stand off."

TOO HIGH

"You're way too high," warns the landing-officer. "Drop down before you try to touch the deck."

never relaxes for a moment in his continual "lookout" for trouble from a slip-stream, freak air-currents, an unusual rise or fall of the deck due to a heavy sea or from a bad approach. If any trouble develops after the landing of the plane, such as fire or blown-out tire, he receives a signal from the flight-deck officer and he waves off the approaching planes until the deck is cleared.

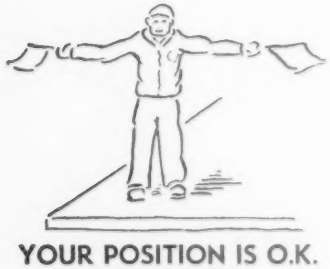
When the landings are summed up at the end of the year it is found that the great majority have been happy landings. A good record is the reward of constant vigilance and untiring effort on the part of all men involved. Among so large a number, of course, there are some imperfect ones and some among these with disastrous outcomes. These are not taken as a matter of course, but are studied thoroughly and the findings used to develop a more perfect system so that a greater percent of "happy landings" will be made.

TOO LOW
PULL UP PROMPTLY

Trouble ahead for the poor pilot if he doesn't pull back on the stick pronto.

TOO LOW
PULL UP SLIGHTLY

Not so bad this time but still low.



YOUR POSITION IS O.K.
NO CHANGE

Happy word—"O. K." Next comes the word to land.

Builds His Own Plane

by THELMA D. PIGG

A PERIOD of eleven months was required to complete the small two-seated, high-winged monoplane described here. It was constructed during "spare time," by Aubrey Blackburne, twenty-one-year-old aviation enthusiast of Columbia, Tennessee.

Despite his youth, Blackburne's aviation career dates back to 1928—at which time he began a barnstorming tour of the South. He is a graduate of the Spartan School of Aeronautics, Tulsa, Oklahoma, and was, for some time, affiliated with Safe Way Airlines. This was previous to his return to his home-town, where he accepted a position requiring ten hours of his undivided attention each day. (NRA hours were unheard of at that time.)

Little time was left for aviation, but, like Stanley Rowan, the Chicago bedroom airplane constructor, young Blackburne had been bitten (way down deep where he couldn't scratch) by the Aviation Bug—and this is what he did about it:

In the Fall of 1932, he began to assemble materials for the construction of his plane, including sheet aluminum and steel which he cut and polished to his own satisfaction. These and other parts for the construction of the ship were purchased, from time to time, from at least seven airplane supply houses. Finally, his major purchase was made—a four-cylinder motor from a wrecked Model A Ford automobile—with which he completed the job. And DOES IT MOTE?

Just ask any one of the hundreds of interested spectators who gathered on the Tolley farm, ten miles north of Columbia and witnessed, for a moderate admission, Mr. Blackburne's recent exhibit and first attempt to fly his home-made plane! Taking off with grace and ease, away he went—up one hundred feet, two hundred feet, thence to five hundred—while the cheering crowd looked on with bated breath.

Suddenly, it became evident that the machine was not in perfect balance and that the pilot was experiencing difficulty in turning the ship. The startled crowd gasped and feared for the safety of the youth when they realized that one wing was too heavy. But young Blackburne's skill was equal to the emergency—for he maintained an even keel and, finally, enacted a successful landing without injury to himself or the machine.

Since the test flight and correction for right wing heaviness, Blackburne has improved the performance by lowering the radiator and making other minor alterations. Up to this time, he has made twenty successful flights—running up a total of five hours in the air.

The ship has a top speed of 95 m.p.h.

(Concluded on page 337)

Stacking the Aerial Bombs

Here the bombs are stacked like cordwood.

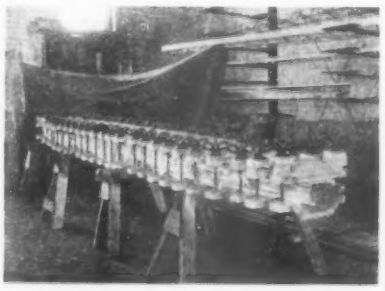
THOUSANDS of aerial bombs of all sizes and types are stored at the various military centers as shown above. These are an investment in our national security which is to be commended.

Special tractor hauled trucks can remove them from the "dump" in an incredibly short time and deliver them to the bombing planes.

Making Wood Props

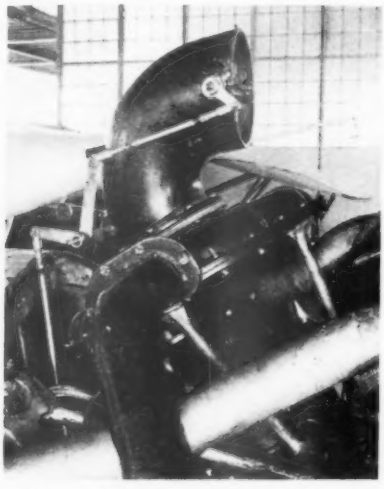
WOOD propellers are nearly always of the laminated type, that is, they are built-up of boards glued together so as to stagger the grain and thus prevent any tendency toward splitting.

After the sides of the wood boards or laminations are given the proper surfaces for glueing, the glue is applied, the boards are stacked with the glued faces together, and are then subjected to the pressure of many heavy clamps as shown below. This forces the glue into the pores of the wood, and when dry, the glued joint is usually stronger than the wood itself. In the old days, when hide glues were used, dampness affected the glue and the props frequently flew apart.



Prop laminations clamped after glueing.

Wiley Post's Supercharger

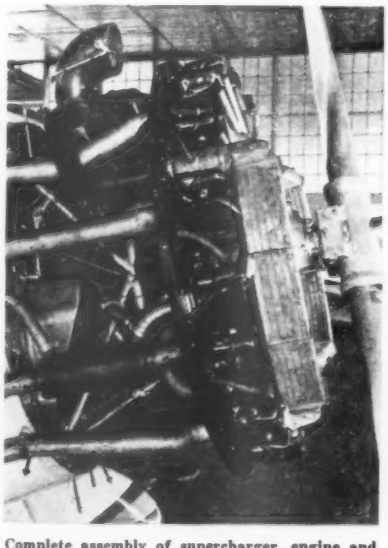


A close-up showing the supercharger stage and the air-inlet of the supercharger. Things are packed in rather tight on this job.

WILEY POST has revamped the power-plant of the Winnie May, adding a double-stage supercharger to the engine and packing in a few other accessories around the engine until the cowl is well filled with various types of equipment.

Probably, the most interesting of the new features is the double-supercharger which is specially designed for flying at high altitudes in the coming MacRobertson races. This gives an exceedingly high supercharge ratio, necessary at the estimated 20,000 feet at which he proposes to prosecute the race in order to be out of the reach of tropical thunderstorms.

The supercharger, built specially for the job by the General Electric Company gives a ratio of nearly 11.00.



Complete assembly of supercharger, engine and air-cooler, on Wiley Post's latest development.

The ZMC-2 Has Fifth Birthday

THIS is the fifth anniversary of the launching of the Navy's metalclad, ZMC-2 airship, at the Grosse Ile Airport, Detroit, Mich.

During this period of time, the ZMC-2 has been almost continuously in operation as a training and experimental ship assigned to the U. S. Naval Air Station, Lakehurst, N. J. She has flown approximately 50,000 miles during her 1,100 hours in the air. Built by the Metalclad Airship Corporation, Detroit, Mich., the ZMC-2 is the first successful airship with the hull, including the hull covering itself, built entirely of metal.

In 1922, a group of Detroit men identified principally with the automotive industry, turned their attention toward the possibility of constructing airships with all-metal hulls, a step that seemed obviously desirable. Considerable experimentation and research were carried on and four years later, Congress was asked for an appropriation, later granted, to defray the cost of building a small experimental unit. Many new problems arose during the actual construction of the ZMC-2, but they were successfully solved by the engineering staff of the builders with the support and encouragement of the Navy Department's own engineers.

At that time, a great deal of skepticism prevailed as to the success of the venture. Gas tightness of seams and durability of the very thin metal required for the hull covering were moot questions. "Alclad," a strong aluminum alloy, now in general use in all types of aircraft construction, was employed commercially for the first time in the building of the ZMC-2.

A special type of seam sealing compound was developed. A unique machine for rapidly riveting thin sheets together had to be constructed. Throughout her five years of service, very careful check has been kept on the behavior of the various materials entering into the construction of the ZMC-2 and they have met fully the expectations of her builders.

The ZMC-2 was an experiment that can be classed as successful. As an airship she is embryonic. Larger airships with metal hulls would depart in many particulars from the features of the ZMC-2, but as a landmark in airship progress and as a testimonial to American ingenuity and skill, this little airship occupies a unique position.

Following table sets forth the characteristics of the ZMC-2:

Type	Metalclad
Volume	202,000 cu. ft.
Length	150 ft.
Diameter	53 ft.
Height	64 ft.
Gross lift	12,200 lbs.
Horsepower	400
Useful lift	3,200 lbs.
Speed	52 knots
Range-nautical miles (cruising speed)	600

Two Old Time Photos

Here's Mickey McGuire at the wheel of his Curtiss Pusher, cap on backwards and everything.

THE other day we ran across two old postal cards showing two old-time celebrities well-known in the early days of aviation. They are Mickey McGuire and Lincoln Beachey, both of whom were expert stunt artists.

So much has been written about Lincoln Beachey, king of the stunters, that it will not be necessary to give him an introduction at this point. His picture shows him in his Curtiss Pusher, which was equipped with a Gnome rotary engine.

Lincoln Beachey, King of the Stunters, had a characteristic pose, close over the forward landing wheel.

Flying Through the Tropics

by

E. STANTON BROWN

Commercial Airways Editor for
POPULAR AVIATION

One of the tri-motor Fokkers in the service of K.L.M. or the Royal Dutch Air Lines. These ships fly one of the longest routes in the world.

FROM Amsterdam, the routes of the Royal Dutch Air Lines reach out like tentacles to London, Paris, Berlin, Copenhagen, Hamburg and Malmo; an integral and important part of the European air network.

Each Thursday, a three-engined Fokker XVIII lifts its load of freight, mail and passengers from Schiphol Aerodrome at Amsterdam and wings to the Orient. The following Thursday, having flown 8,626 miles over seas, deserts and jungles, it deposits its precious load at Batavia, Java, in the Dutch East Indies.

In many ways, the Koninklijke Luchvaart Maatschappij (Royal Dutch Air Lines) is one of the most interesting of European aviation enterprises and a survey of its activities reveals several items which could be noted to the advantage of our own air-lines.

K.L.M. has not been loath to learn from us and has exhibited a most striking impartial attitude in their recognizance of the excellence of equipment, whether or not it has been European. Twenty of the 31 Fokker planes owned by K.L.M., at the end of 1933, were equipped with American engines (Wright Cyclones, Pratt and Whitney Wasps and Hornets). In addition, a number of four-engined Fokkers, of the F-XXXVI and F-XXII types, are on order. The former are to be equipped with Wright Cyclone F-3 engines and the latter with P. & W. Wasp TIDI engines.

Eclipse, Smith and Hamilton variable pitch propellers have been tested on the lines and approved, with the result that the speed of the Fokker F-XII type was increased from 104.5 m.p.h. to 112 m.p.h. and the F-VIII type to 109 m.p.h. A new Douglas 14-passenger transport has been purchased also.

During 1933, Parmentier, one of the K.L.M. pilots, was sent to America to study and gain experience in night flying, a phase of transport aviation which has been too much neglected by European air-lines. The head of the motor section and the head mechanic at Schiphol Aerodrome also paid a visit to America. For six weeks they studied at the Pratt and Whitney and Curtiss-Wright factories and held discussions with their respective managers.

Efficiency, like cleanliness, is an integral part of the Dutch character and it is exemplified in the regularity of service maintained on K.L.M. On the thirty-three European services operated, 98.2 percent of 4,757 scheduled flights were completed on schedule. But one flight was not completed because of technical trouble and only two flights were behind schedule for that reason. Bad weather, which for the most part means fog on the Amsterdam - London, Amsterdam-Paris routes, on which almost all of the trouble occurred, caused 40 flights to be cancelled, 7 to be forced down after taking-off and 27 to be delayed. All-in-all, a rather commendable record.

On the Amsterdam - Batavia route, efficiency was practically 100 percent. A few flights were delayed because of weather, but on the whole it was quite close to a perfect record. An interesting comparison showing the reduction of time en route on the 8,626-mile Amsterdam-Batavia (Java) flight is given in the statistics for the last three years.

	Flight Out	Flight Home
1931.....	11.79 days	10.50 days
1932.....	10.50 days	9.80 days
1933.....	9.80 days	9.10 days

With the new speedy equipment, such as the Douglas and new Fokker planes, the time on the Oriental route will undoubtedly be still further reduced.

The Fokker XVIII planes used on the Amsterdam-Batavia route, while not particularly speedy from the American point of view, have proved quite satisfactory as to reliability and comfort. They are equipped with three Pratt & Whitney Wasp C engines of 425 h.p. each, and cruise at 124 m.p.h. with a top speed of 155 m.p.h. A fuel capacity of 531 U. S. gallons gives a range of 1,100 miles. The oil capacity is 16 U. S. gallons.

Complete two-way radio equipment is standard on all ships and operates both for radio telephony and telegraphy. A wireless operator is included as a member of the crew whose duties are confined to operation of the radio equipment.

It is quite startling from our viewpoint to learn that the planes have a crew of four, a pilot, co-pilot, mechanic-steward and radio man and at the same time carry only four passengers. Com-

A bird's-eye view of a huge tea plantation on the route of the Royal Dutch Air Lines, a typical scene in tropical Asia.

s on the Royal Dutch Air Lines

STUDENTS of American commercial aviation will be greatly interested in the operation and equipment of the Royal Dutch Air Lines, one of the longest airlines in the world.

It is quite interesting to note that this line employs much equipment of American manufacture in addition to the Fokkers exclusively employed in the past.

High above the paddy fields and terraces, the transports of the K.L.M. fly on a regular schedule. It is here that the ox-cart and airplane meet, representative of ancient and modern transportation in strong contrast.

fort, an absolute necessity in the equatorial countries, is placed above all else.

The cabin is spaciously arranged. A chart table and the radio man's equipment occupy the left forward portion of the passenger cabin. The four passengers are located three on the right side of the cabin and one on the left. Large easy-chairs, which can be lengthened to form a sort of "chaise lounge" with an adjustable back, are provided.

While the passenger revenue may seem small from only four passengers, it must be remembered that European countries recognize the value of air transport to the extent of subsidizing a greater portion of the operating expense. The lines are particularly valuable when they link colonies with the mother country.

Our own government might take a much needed lesson in this respect and do something in the way of a subsidy to encourage and assist in the immediate development of important air routes to the Hawaiian Islands and Alaska.

During 1933, reductions were made in passenger fares and freight rates on the Amsterdam-Batavia route, with the result that the whole traffic showed an upward trend and the receipts were far above those of 1932. On this route 2,198,133 passenger miles were flown in 1933. The 1933 figures for freight, mail and parcel post are as follows:

Freight..... 105,751 ton miles
Mail.....1,048,624 ton miles
Parcel Post..... 20,179 ton miles

In addition to the regular route from Europe to the Dutch East Indies, the Royal Dutch Air Lines works in close cooperation with the K.N.I.L.M. (Royal Netherlands India Airways) which takes charge of the local traffic in Netherlands India. The K.N.I.L.M. operates between the Malay States and the Islands of Sumatra and Java.

Last year, the line flew 536,678 miles over the vast paddy fields, mountains, jungles and queer peaked-roof native houses. 13,078 passengers were carried, of which 2,554 were joyride passengers. Efficiency was 100 percent on all lines with the exception of the Bandoeng route (efficiency 99.76 percent) and the Medan route (efficiency 99.04 percent).

The fleet of the K.N.I.L.M. consists of eight Fokkers—two F-VIIb (3 Bristol "Titan" engines); four F-VIIb (3 Siddeley "Lynx" engines); and two F-XII (3 Pratt and Whitney "Wasp" engines).

On the Amsterdam-Batavia route of K.L.M., all flying is done in the daytime, in from 8 to 12 hours a day. Passengers spend the night at a comfortable hotel where reservations have been made for them. All expenses for meals and hotel accommodations are included in the original fare as well as transportation from the fields to the towns and return.

A tri-motor Fokker flies over the pyramids of ancient Egypt.

In addition to K.L.M., the British Imperial Airways and the French line, "Air France," operate respectively to Singapore and Indo-China, from Europe. An amazing degree of cooperation exists between the three lines in a manner unheard of in the United States, where competition, and often cut-throat competition, is the rule. A passenger flying down on one line may return on either of the other two, if he should wish to, and still be granted a ten percent reduction on round-trip fare. Such an agreement between our air-lines might result in an additional increase in passenger traffic.

Traffic on the European lines of K.L.M. has outdone even the general uptrend of air transportation throughout the world. Passenger traffic surged up from 20,877 passengers in 1932 to 40,917 in 1933, an increase of 96 percent. At the same time the Amsterdam-Batavia route showed an increase of 105 percent over 1932.

The maintenance department, in Europe called the "technical service," is based at Waalhaven Aerodrome, Rotterdam. During 1933, the department was kept busy with the installation of American engines in many of the ships, with the testing and applying of American variable pitch propellers and with new electrical installation in the planes. This latter work was the outcome of the beginning of night flying on K.L.M.

All ships had to be equipped with night flying equipment. The installation of landing lights in the wings required many changes. Absolutely new designs had to be drafted in many cases and a large number of auxiliary parts not generally used for aviation pur-

poses in Europe, had to be manufactured in the workshops of K.L.M. At the same time electric starters were installed in the fleet.

It is interesting to note that considerable work was done on installing fixed windows and ventilating systems in the ships, a system which has been in use in America for some time.

Schiphol Aerodrome at Amsterdam is the center of the activities of the Operations Department. On September 28, 1933, a landing radio beacon was installed by the Air Service of the Department of Public Works. While no details are available at the moment, it is understood that it works quite successfully in bringing in ships in foggy weather.

For taking-off in foggy weather, a "fog-arrow" is used. This consists of a white arrow, over a thousand feet long, beside which the start is made, indicating the right direction for taking-off. One should think, however, that the use of neon lights marking the take-off, spaced fifty feet apart, would be more dependable. The conquering of fog in the North Sea and Channel areas is probably more important than almost any other place in the world.

One of the very interesting things about K.L.M. is the work they do in getting people out to their fields where they can come in direct contact with educational publicity work. At Waalhaven, a permanent exhibit is maintained of various airplane models of ships used on the line. Visitors are conducted through the hangars and shown behind the scenes.

Such a practice in the United States would do a great deal toward educating the general public out of ignorance and prejudice in regard to air transportation. Permanent exhibits at such important points as Chicago, New York and Los Angeles, from which several air-lines operate, could be maintained cooperatively by the lines in conjunction with the Department of Commerce.

Mock-ups of cabin interiors, airway lighting equipment, safety aids, radio beacons, graphical representations of operations, working models showing why an airplane flies and many other

An interior view of a passenger cabin used in the Fokker XII's operated on the "K. L. M." or Royal Dutch Air Lines.

things about which the general public knows little or nothing, would do much toward intelligent education in aeronautics, education which is necessary before the man in the street will take to the airways.

Just how important this is, is shown by the fact that 85 percent of air passenger traffic consists of business men, for the most part executives, who use the air-lines to save time. The great traveling general public has yet to be tapped.

Last year 150,261 people visited Schiphol Aerodrome, merely to look around. The great majority of the visitors took advantage of the opportunity of inspecting the various buildings under expert guidance. Waalhaven was visited by 98,794 people.

One cannot help but attribute a portion of the 96 percent increase in air passenger traffic within a year to this sort of educational program. In addition to passenger, mail and freight lines, K.L.M. also maintains a Photo-technical Service. During 1933 there was almost 100 percent increase in the mapping work this division carried out. A regular photo-pilot is stationed at Waalhaven. The cooperation between a pilot who understood the technique of photographic work and a skilled navigator, saved considerable flying time.

A great deal of work was done on behalf of the new Road Scheme of the Dutch Government as well as revision of several river charts. The whole dune district from the Helder to the Hook of Holland was mapped. All-in-all, 277,372 acres were photographed during 1933.

Air transportation in Europe is on the uptrend. Night flying is coming in, the need of faster ships is being felt, as is shown by the K.L.M. buying a Douglas and the new swift Fokkers, by the purchase of Curtiss-Wright Condors and Lockheeds by Swissair and of Boeing 247's by the Luft Hansa. It will be interesting to watch the development and growth of K.L.M. as one of the finest air-lines in Europe.

END

The Story of "Miss Los Angeles"

MISS LOS ANGELES is a Menasco powered racing plane, built and designed by Lawrence W. Brown as a challenge to the super-powered racers that have hitherto dominated the picture with engines in the 1,000 h.p. range.

While her speed is only 270 m.p.h. on the straight-away, miles below the straight-away speed of the heavy planes, yet her over-all speed on a triangular course is expected to be better for the Miss Los Angeles is so clean and lightly loaded that she will prove faster on the pylon turns. It is expected that she will win on the turns rather than on the straight runs, by a good lead of 20 miles.

She is powered with a Menasco C-6-S "Buccaneer" engine of 300 h.p. It is indirectly related to a military pursuit ship with the same size engine now projected by Mr. Brown as he believes that there is a field for a small fighter that will bear the same relation to the larger fighting planes that a torpedo-boat destroyer bears to battleships in the Navy.

Such a ship, with a wing span of but twenty feet, and weighing less than 1,000 pounds empty, will carry two 0.30 caliber machine guns and will have a top speed of 220 m.p.h. Because of its small size and light weight, it would be extremely maneuverable and hard to detect from either the ground or air, making it an ideal combat ship.

The Miss Los Angeles is a thin-wing wire-braced plane with a rigid landing-gear and composite construction. The fuselage is of welded steel tubing while the wings are of wood construction with two solid spruce spars, spruce and plywood ribs being spaced at increasing intervals from root to tip. Steel tube is used for the drag struts and wire for the tension drag members.

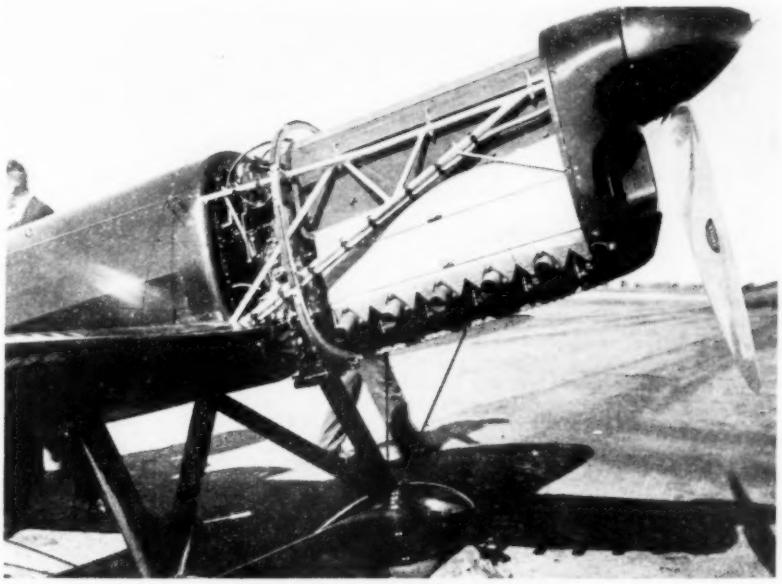
The airfoil section is a modified Curtiss racing type with an unusually sharp nose, and a unique feature is the employment of two-ply cloth at the nose in place of a rigid leading edge of plywood or metal. The cloth is said to offer greater resistance to tearing and is lighter than the more common plywood reinforcement.

Another interesting feature of the wings is the incorporation of wing-flaps that extend about one-third of the semi-span and which occupy about 30 percent of the wing chord. They are of the simple trailing-edge type, operated by a pull on a single lever which works through torque tubes. The ailerons are also operated by torque tubes which pass through the torque tubes that operate the flaps.

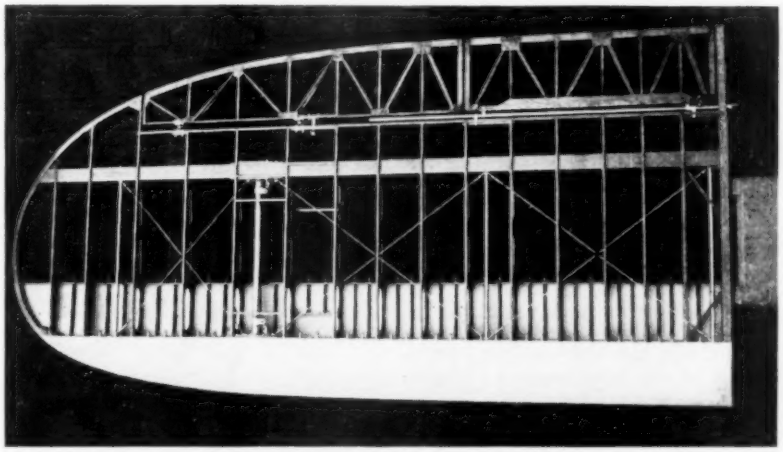
The fuselage has been "tailored" to a fine fit for both the pilot and the engine. When the owner, Mr. Minor, is seated in the cockpit, there is not a fraction of an inch to spare in any direction and yet he is able to sit in a

(Continued on page 328)

Lawrence W. Brown, designer of "Miss Los Angeles."



The installation of the Menasco engine.



The wing structure of "Miss Los Angeles."

Return of the Dream-Ships

BY the special request of a multitude of our readers, we are restoring the dream-ship department to P.A. To judge from the number of sketches submitted and from the number of wails that arose when the column was discontinued some months ago, dreaming airplane designs is one of the most popular occupations engaged in by our younger readers.

And so we have been compelled to run this column again, although some of the drawings may strike horror into the hearts of our technical readers. But please remember that we are neither for nor against the designs submitted and that we are simply gratifying the craving for publicity that many desire. Take 'em or leave 'em, as you will, the dream-ships hang around old P.A. still.

First, and at the top of this heap will be seen the photographic plane, which like a movie director, bellows "camera." This contribution, by Murry Dunne, looks more like an English interceptor or pursuit plane than a photo-plugger, but then he may count on using the new quick-speed film that is being so well advertised. Sure is a snappy looking little bus, no matter how well it may or may not match up with its requirements.

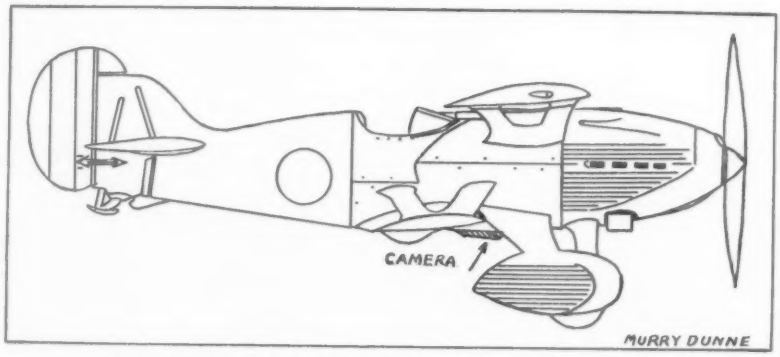
Joseph Cylinski, second from the top (and also from the bottom), sends in an O.C. job that is more distinguished by its interplane bracing than anything else. It is undoubtedly an entry into that celebrated $700 class to judge from its appearance, but even yet we can't get the reason for the gulled wings that nestle so trustfully on top of the gas-pipe cabane struts. Attaboy, Joseph, this will get the public up in the air if nothing else will.

Down at the bottom, we have the contribution by H. A. Thomas, who sends in a three-view layout of a sportplane, or lightplane as they laughingly call it. It introduces a novelty in the way of a surface that acts both as a lower wing and an aileron. This is not at all bad if the designer has doped out some method of strengthening the aileron-wing at the trunnions or pivots.

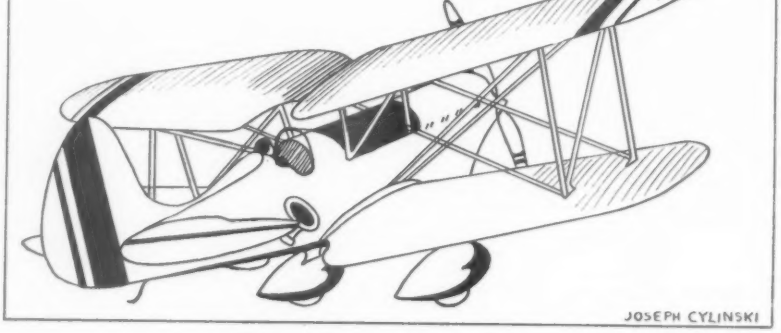
A plywood center-section carries two 15-gallon gasoline tanks which feed by gravity down to the radial engine. He has adopted the Clark "Y" section for reasons best known to himself, but has neglected to specify the horsepower of the engine. But all in all, he has shown some knowledge of design and drafting and has gone farther than many of our contributors with his design. It is a nice looking little lightplane.

And so-o-o, we have completed the first of the deluge of ideas. For those of you, who have not seen your brainstorms in this department, we suggest that you use more care in making the drawings.

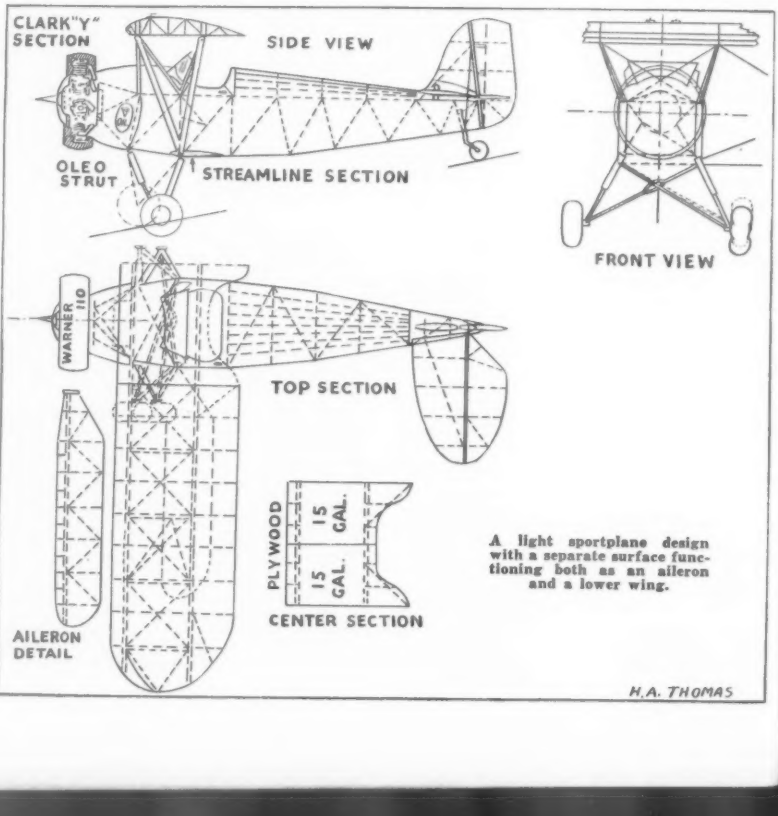
END



This is a camera plane of the high-speed type with a liquid cooled engine.



Rear view of Joseph Cylinski's biplane.



A light sportplane design with a separate surface functioning both as an aileron and a lower wing.

Has the Rocket a Future?

by HELEN S. WATERHOUSE

A group of young men in Cleveland, Ohio, answer the above query in the affirmative. To this end they are dedicating a great deal of time and money.

THANKS to the stories of Jules Verne, any mention of traveling by rocket through the air usually brings a cynical smile to the face of the listener and apparently a picture arises of a wild trip to the moon through showers of meteors or star dust.

Yet anyone delving into the subject at all soon finds that throughout the ages men have been experimenting with the rocket idea of traveling through space, experimenting with it seriously, and that it is no longer a mere dream that the thrum of the airplane's motor will sometime become the swish of the rocket.

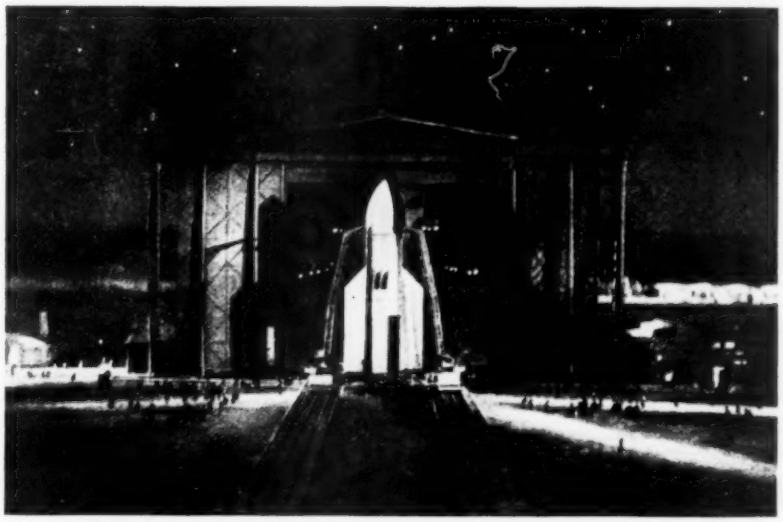
Rockets played a big part in Napoleonic wars, rockets made of iron which were afterwards the inspiration for the line, "the rocket's red glare" in the national anthem, and which served in all warfare until the range finder was discovered and the rocket as a weapon became obsolete. Then, along came the fiction writers with their wild tales of rocket trips to the moon, and of lives saved at sea by rockets carrying life lines, but beyond being thrilling stories, they accomplished very little towards the serious study of the rocket.

Finally, about ten or twelve years ago, after the gunpowder rocket had been found inefficient, scientists began to experiment with a new type of rocket, a rocket filled with gas and liquid fuel instead of gunpowder and which was capable of propelling itself in a vacuum.

There was a Dr. Robert Goddard, who was one of the successful first experimenters with the idea of building a rocket big enough to be capable of moving in a vacuum. Then rocket societies began to spring up, of which the Interplanetary Society was the largest, and experiments went further. Men attempted to fly rocket-motored planes to the stratosphere—from which they hoped to bring down valuable information which would aid future flying of mail and commercial planes in the calm, rarefied, upper regions.

Finally, on November 4, 1933, a rocket, carrying Otto Fischer, ascended to an altitude of six miles from the Isle of Ruegen in the Baltic. Liquid oxygen and gas were used for fuel and the rocket motor in this case was 20 feet in length and three feet in diameter. It was mounted on an outrigger extended out in front of the main body and had a lifting power of 1,500 pounds. The energy converted within the combustion chamber corresponded to 15,000 horsepower.

The pilot and the rocket landed safely in separate parachutes within ten minutes after taking off. Fischer was therefore the first man to carry out the scientists' dreams of the ages. He had really flown in a rocket!



Looking into the future. An artist's conception of a passenger rocket about to leave its terrestrial airport for the regions beyond.

Meanwhile, two young men in Cleveland, Ohio, were working doggedly and persistently, perfecting a rocket motor which should be able to plunge through the air at 900 miles an hour and bring back from the stratosphere samples of high altitude gases and other scientific data which would give much valuable information about the upper air. This data was to be applied not only to future aircraft flights in the stratosphere but also to meteorological research. They were very serious and business-like in their endeavors.

One, Ernst Loebell, a young graduate of two European engineering colleges, had long been interested in the development of rocket motors. He had come to this country in 1929, hoping to interest people here in the great new idea of flying through the stratosphere in a rocket-motored plane. At first he met with little success.

It was not until he exhibited his tiny rocket motor, which looked like nothing more nor less than the head of an iron bed post, at the Technicraft Show in Cleveland last year, that recognition came. By chance, young Edward Hanna, scion of an old and wealthy Cleveland family, strolled into the show and stopped to look over Loebell's motor. Hanna, as a licensed airplane pilot, was naturally interested in all developments along aviation lines.

The engineer, glad of an audience at last, eagerly explained to young Hanna that this was the only known engine that would really work in the stratosphere. He showed him his model. "See, it is but six inches long, bullet-shaped and hollow," he pointed out. "It is made of chrome-nickel steel and it consists only of a combustion chamber. It has no movable parts.

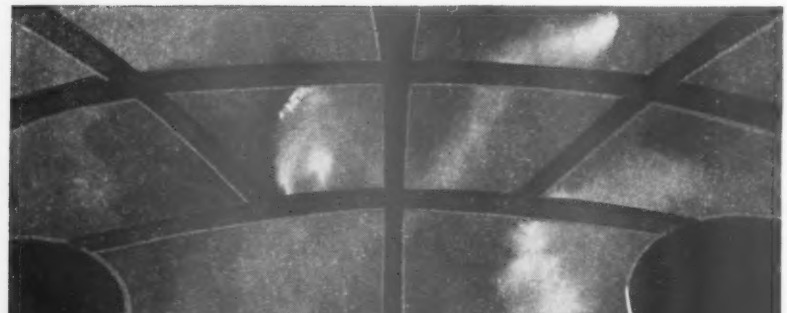
"But my one ambition," he added, wistfully, "is to apply this rocket motor to an airplane and to prove that that airplane will go higher and much faster than any plane ever has. I must, however, have a 'proving field' where I can make my tests."

Young Hanna was intrigued with the idea. He offered Loebell the big field at the rear of his father's estate on the Lake Erie waterfront near Cleveland as a testing place for his motors. Together, they organized the Cleveland Rocket Society which, from a feeble beginning, grew to have a score of interested members or more. After a few rather disastrous experiments in which explosions occurred, they dug trenches in the field from which they could observe the action of the motor in safety, and donned steel helmets to protect their skulls against future possible explosions. But all the time they were progressing slowly and steadily towards their goal.

"First, we will perfect our small rocket motor," said Loebell sensibly. "Then we will apply this motor to an airplane and prove that that airplane will go higher and much faster than any previous planes. We will fly this

(Concluded on page 336)

A Proposed Rotating Radio



The position of the revolving radio beams and the airplane appears in graphic form on the viewing screen in the cockpit. The pilot can grasp the situation in a glance.

by

LAWRENCE J. LESH

Pioneer experimenter in aircraft radio communication.

RADIO navigation has developed under four general systems, three of which are extensively used today. These systems will be briefly described and compared with emphasis on the fourth or unused method which seems to deserve most careful study.

1. Bearings transmitted from fixed stations.
2. Directive reception of fixed stations.
3. Fixed patterns or beams.
4. Rotating patterns or beams.

The first system using radio bearings, transmitted from fixed stations, is widely employed for guidance of ships at sea and airplanes on the European airlines. With this method, the ship or plane desiring position report must be equipped with a radio transmitter. Fixed stations hearing the call for position determine the bearing of the transmitter by means of directive receivers and, by simple triangulation, chart the position and inform the ship or airplane.

Obvious objections to the system are the requirement of a transmitter on every airplane and confusion and delay if several airplanes ask for a position report at the same time. The fixed stations must be manned by at least two operators in contrast to other systems not requiring manual operation.

The second system, employing directive reception of fixed stations, involves the use of a directive receiver on the airplane or ship, usually a coil or loop which may be rotated to determine the direction of fixed stations or else rigidly attached to the airplane in which case the whole ship must be turned to use the direction finder. The rotatable loop is properly called a "Radio Compass" while the fixed loop with the radio receiver is commonly described as a "Homing Set."

The radio compass requires manual operation by the pilot and the rotatable loop presents difficult installation problems, particularly on all-metal ships where it must be exposed outside the metal shell. The homing set, on account of its simplicity of operation, is gaining favor but imposes a weird flight path on the pilot aiming toward a certain radio station as his destination. The nose of the ship may point steadily at his objective but sidewinds will cause him to follow part of a spiral course rather than a straight line.

The third system, of fixed patterns or beams, is that now developed to a remarkable extent in the United States based on the original method of Bellini-Tosti in Italy and known as the "Radio Goniometer." The American adaptation consists of numerous radio transmitters stationed along the airways that send out course signals, station identifications and weather information. For defining the flying course, a radio fixed pattern is broadcast consisting of two overlapping figure 8's generated from a common center and at right angles to each other. The pattern, if visible, would somewhat resemble a four-leaf clover with leaves overlapping. Provision is made to alternately energize the opposite pairs of leaves with different signals and along the lines where the signals overlap, of course, a continuous "mush" or mixture is heard.

The letters "A" and "N" consisting respectively of dot-dash and dash-dot are now in use to identify the quadrant pairs but may be replaced in the near future by a simple dot for one pair of quadrants and dash for the opposite pair.

This system of fixed quadrature patterns provides well-defined flight tracks for airlines operated between large centers of population but does not provide radio navigation for airplanes flying off the recognized routes. The great promise of aviation was that it would enable us to fly like the birds in a straight line to our destination instead of following roundabout roads or waterways as required with land and water bound vehicles. Theoretically, the present radio pattern gives the pilot some indication of direction and position in off-course flying but practically it does not work out so well, even skilled transport pilots being skeptical of the present and future possibilities of the system.

The greatest objection to the system is, that once a pilot enters the broadcast zone of the "quads," he must do a lot of flying to find out just where he is and in what direction he is flying.

Beacon for Air Navigation

A VERY ingenious rotary radio beacon has been devised by Mr. Lesh, which at least apparently, solves many of the problems now experienced in blind flying.

Mr. Lesh, be it known, is a prominent radio engineer who constructed the radio transmitting station WCFL a few years ago. He was one of the first men to experiment with aircraft radio at the Hammondsport plant of Curtiss.

This performance, called "orientation," reminds the writer of a game called "coffee potting" where the victim enters a room and tries to guess a word known to his inquisitors by an involved process of questions and insinuations. "Orientation" is all right as a game but who wants to play games in a fog?

As a matter of cold clammy fact, the limitation or direction of aircraft travel along narrow routes is dangerous in proportion to the traffic increase. Any groove in the air, bustling with airplanes flying blind, in the future, is going to mean collisions and personally I want no part of it.

Obviously, what we want is something in the nature of radio sign posts marking off the points of the compass as radiating from centers such as Chicago, Detroit, etc. The intersection of these radii would then tell us exactly where we are all the time. This could be accomplished by a multiple radio beam transmitter shooting out beams, let's say to each ten degrees of the compass with voice announcement on each beam, but such an affair would involve 36 transmitters at each station and the cost would be prohibitive.

We may be able to get practically the same result at reasonable cost by the use of rotating beams swinging around the sky like rotating airport beacons or searchlights and this is the system that I propose to describe and illustrate in some detail.

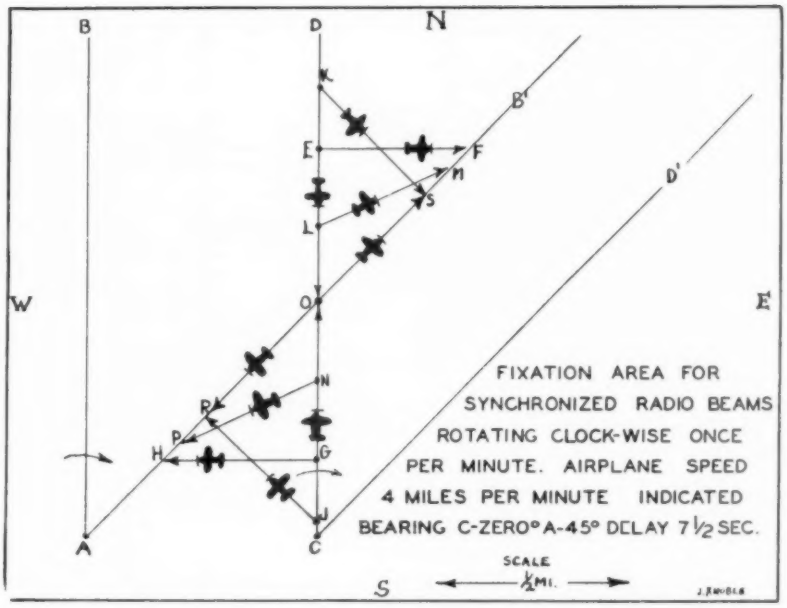


Fig. 2. Showing how the pilot can determine his position by means of the synchronized radio beams.

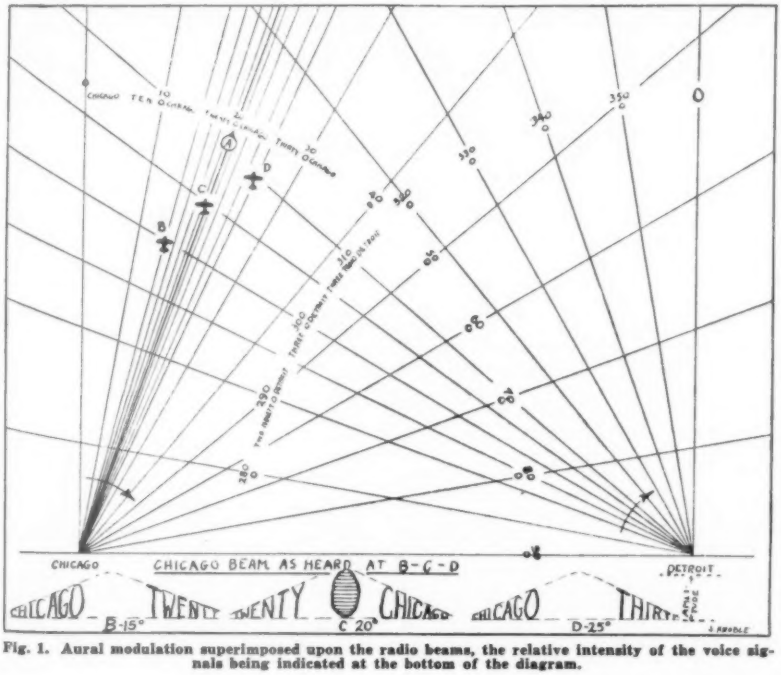


Fig. 1. Aural modulation superimposed upon the radio beams, the relative intensity of the voice signals being indicated at the bottom of the diagram.

A rotating radio beam may be projected in either one of two ways: first, by rotating the entire aerial and reflector and second by arranging aerials around the circumference of a circle and energizing them successively. The rotating aerial or radio lighthouse has been built and tested by the British Marconi Company on a wavelength of six meters. The aerial and reflector structure designed by C. S. Franklin was about sixty feet long and thirty feet high, rotating once every two minutes. The polar diagram of radiation from this affair shows a beam effectively less than ten degrees in width with greatest intensity along the center line. This is equivalent to saying that, with adjustment of volume control or R.F. sensitivity on a receiving set, this beam could be considered as a sharp pointer or contact point sweeping the sky and not as a constantly spreading ray like a searchlight beam.

The second method of rotating a beam by the successive energization of aerials arranged in a circle was built and tested by the German Telefunken Company. Both of these rotating beam systems were devised and used to give radio bearings to ships at sea. The ship operator was supplied with a special stopwatch which he started when the beam passed zero degrees or true North, a sharp non-directive signal being radiated at this point.

The hand of the stopwatch would then travel around at exactly the rate of the radio beam and when the beam hit the ship's radio the operator would stop the watch, the hand then showing

him his true bearing from the radio beacon. This determination of the beam direction as a maximum signal was later substituted by a method where the two minima or thresholds of the beam were taken, the true bearing being half way between these points on the dial of the stopwatch.

The above rotating beam method, while satisfactory for ship position determinations, would not be entirely suitable for aircraft. The beam should be rotated faster so as to sweep the circle at least once per minute and preferably once every thirty seconds. This latter result may be accomplished by using a bilateral or double beam rotating once per minute in which case two rotating beacons would intercept a receiving set in range once every thirty seconds as a maximum and, if the beams were rotating in the same direction, the greatest delay between the sweep of the beams across any point in range would be fifteen seconds.

If the airplane were traveling 240 miles per hour, or four miles per minute it would travel one mile between the time of determining the lines along the first beam and the second beam. A complete fix from two rotating beacons would occur every thirty seconds or two miles of flight.

In addition to stopwatches or similar synchronized rotating pointers, stopped and started by the airplane pilot for fixing the bearing angles, it is almost essential that some method be developed requiring only a simple airplane receiver and no special instruments for observation.

Aural determination of the bearing of the beam, when it acts on the aircraft radio receiver, will be possible if the beam is modulated by mechanical voice as it sweeps the sky, announcing every ten degrees (Fig. 1), the origin of the beam and the angular bearing therefrom. For example, CHICAGO DASH TEN CHICAGO DASH TWENTY CHICAGO DASH THIRTY, the dash occurring at exactly ten, twenty and thirty degrees. Study of this method reveals that the relative volume of the words and dash would differ accordingly as the position of the plane were exactly on the ten degree bearing or on one side and that the pilot should be able to get his bearing by sound within two or three degrees.

Having determined his line of bearing from two rotary beacons I have illustrated (Fig. 2) how the pilot may accurately determine his position. In the diagram showing fixation area for synchronized radio beams, the position of the plane is first determined as somewhere along the line of (C-D) the origin of the beam being at (C). Beam (C-D) sweeps on to position (C-D^1) and beam (A-B) finds the plane along a new bearing (A-B^1). During the seven and one-half seconds elapsed between the beams the airplane starting from some unknown point along (C-D) will have traveled one-half mile to show up for the second bearing along (A-B^1). The possible movements of the plane in straight flight during this period cover a rather small area of fixation. I have illustrated ten of the possible excursions of the airplane.

If the pilot knows from his compass the direction of flight he may now determine his exact position in the fixation pattern. For example, flying either north or south, his true position will be at (O). Flying due east, his position will be (F) and due west his position will be (H). Note that only a rough compass reading is required to give him a very good idea of his position. For example, flying any path from southeast to northeast, or ninety degree accuracy, this method tells him that his position is somewhere in the compact group of terminal points S, M, F.

It appears possible, under this system, for even an inexperienced pilot or navigator to get his bearings by radio with a possible error of not much more

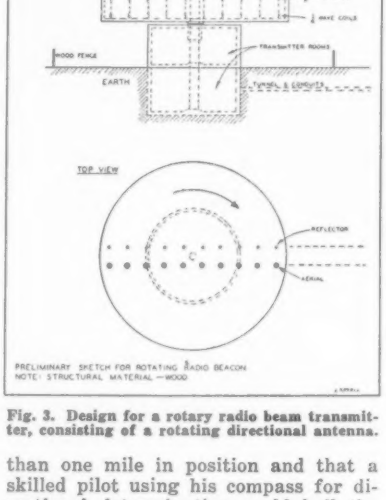


Fig. 3. Design for a rotary radio beam transmitter, consisting of a rotating directional antenna.

than one mile in position and that a skilled pilot using his compass for directional determination could boil the error down to a much finer point. The skilled pilot would regulate the sensitivity of his receiver so that the beam tip alone would operate the set in working for high accuracy of bearing.

By proper apparatus in the pilot's compartment, it is possible to construct a view screen which greatly assists the visualization of the course and location by the pilot. He has the whole picture before him at every instant so that he knows just where he is at every moment without the necessity of making calculation or adjusting instruments. This device is illustrated at the beginning of this article.

The visible allocator, located on the instrument board, is an amplification of Fig. 2. On it, the radio beams rotate in synchronism with the main beams, while the ship's position stands out prominently against the dark background. Virtually, we have a motion picture map that is up-to-date every second that the ship is in the air so that errors in reading dials would be eliminated.

Boeing Is Awarded Medal

WILLIAM EDWARD BOEING, awarded the Daniel Guggenheim Medal for successful pioneering and achievement in aircraft manufacture and air transportation, became interested in aviation nineteen years ago. Out of his hobby for flying grew the world-famous Boeing Airplane Company of Seattle, producer of both commercial and military planes, and, subsequently, the foundation of the nation-wide air transport system now operated by United Air Lines.

Mr. Boeing was born in Detroit, October 1, 1881; received his early schooling both in this country and in Switzerland and entered Yale University in the class of 1904. After attaining his majority he spent five years at Grays Harbor, Washington, learning the logging business. Mr. Boeing's timber and mining interests did not prevent him from indulging in a hobby—the science of aeronautics and flying. In 1915 he learned to fly at Santa Ana, Cal., and at Seattle.

Oddly, an accident led to the Boeing Airplane Company's establishment. A seaplane which Mr. Boeing had been flying was damaged in landing. While making repairs, Mr. Boeing hit upon the idea that he and a group of associates could build a seaplane of their own. He consulted with other hobbyists and such aeronautical experts as were available. Before long, the first Boeing plane was in the air. Before long, Mr. Boeing was in the aircraft manufacturing business.

In July, 1916, the Pacific Aero Products Company was formed and the following year was given the Boeing name. From a one-room shop with a handful of employes it has grown into a plant of thirteen buildings, occupying 332,000 square feet of floor space. Since its establishment it has produced more than 1,800 planes of fifty-six different types.

The Boeing company's original success was based entirely on military plane development. In 1927, however, the Boeing interests branched out into the air transportation field as the lowest responsible bidder for the San Francisco-Chicago air mail route. Subsequently, this and the Pacific Coast route, also operated by the Boeing interests, became a part of the United Air Lines' system.

During the period of its operation, the United Air Lines built up a wonderful record for reliability and accuracy to schedules.

The Boeing Airplane Company has gained new recognition in the past year with its production of all-metal, high-speed military and commercial aircraft, including seventy-five three-mile-a-minute transports for United Air Lines and the general market. Mr. Boeing now is chairman of the board of the Boeing Airplane Company and of United Aircraft and Transport Corporation.

The Alcohol-Gasoline Fiasco

by KEITH J. FANSHIER

Just how the aviation industry was saved a lot of trouble when the crop failure spelled the end of the proposed alcohol-gasoline fuel previously advocated for economic reasons.

AVIATION can thank its lucky stars, or whatever forces are responsible for the so-called disastrous drought of the past summer. Because for aviation it was not a disaster. It was an element of good fortune. This was surely an instance of the ill-wind which blows nobody good. This situation works out in this way:

The drought has wiped out surplus supplies of American farm crops, and appears to have been the major factor in putting into effect a strong price advance for major cereal products, particularly corn. And how, you may ask, is this such an instance of such great good fortune to aviation? I'll tell you how.

It "put away on ice," at least for the time being, and quite possibly for all time, the ambitious scheme of various interested parties and organizations (and of course some distinterested ones as well) for the blending of grain alcohol with the nation's gasoline supply to make compulsory an alcohol-base motor fuel. There is no question in the mind of this writer, nor in the minds of many others who have gone into this question to any important extent, that such a program would have been one of the worst misfortunes which aviation could have or ever has endured, and it has endured its share, and then some.

This writer ventures to hazard expression of the thought, for example, that, had alcohol-gasoline legislation which was pending some months ago in Congress actually gone through to a successful conclusion, and had alcohol-gasoline blending been extended to aircraft on a large scale—which would have been a logical and complementary phase of the main plan—the results would have been heart-breaking; and that term is used here deliberately and advisedly.

In other words, I believe the nation would have seen air tragedies on a wholesale scale, due to engine failure, the like of which has never been witnessed, even in the airmail fiasco of early this year. This did not come out as an element in the discussion of the corn-alcohol question at all, but from a calm, unbiased, thinking and well-considered standpoint, I feel it should have received first consideration. After all, none of the many objections to alcohol-gasoline motor fuel which were brought to light stressed any danger to human life. But in the opinion of experts who should, and do know, lives of many flyers would have hung in the balance, and actually did hang in the balance while the legislation was nearly an accomplished fact.

Photo by U. S. Army Air Corps

A view of a gasoline storage plant and supply depot as erected for the U. S. Army Air Corps.

While the writer is no prophet, the best current information supplies the basis for reasonable belief that the recent performance of grain prices in the markets and the expressed opinion of leaders of the grain trade that grain prices are due for even higher levels, takes the edge off any alcohol-gasoline blending campaign and makes it extremely unlikely that any alcohol-gasoline blending legislation will be passed soon, if at all.

In the first place, no new artificial consumption scheme for grain products is necessary. Grain prices are doing quite well for themselves, thank you. In the second place, the spectre of a grain shortage has raised its head and it is hardly likely that even some of the minds gracing the halls of Congress would be willing to back a plan to divert needed domestic grain supplies to a non-food utilization with the possibility near of an acute need of all available grains for the nation's breadbasket.

Here, then, is one trouble which aviation seems to have side-stepped. Let it be hoped that it stays side-stepped.

The principle cause of predicted trouble from attempting to blend alcohol with gasoline is the almost certain separation of the blend into strata in the presence of any noticeable amount of water. And under such conditions it is widely known that a certain amount of water is inescapable. Stratification of such a motor fuel would almost surely cause trouble in an internal combustion engine in operation under circumstances such as exist in air service.

The thing which appears to have put the kibosh on the whole alcohol blending campaign, with those who were actively pushing it in 1933, is not so much that there is a suggestion of a dearth of supplies, as that the anticipated lift to the price of corn, wheat, oats and other grains to be caused by compulsory blending and thus increasing the price is not now needed to any such extent as a year ago.

It is not now desirable to expand the demand for the grains. Surpluses held to be so threatening a few months ago have dropped from sight. Old Mother Nature has calmly seen to that. Corn, for example, is now around 80 cents a bushel in leading markets and some observers have taken the position that it may very well hit or exceed the long-mythical figure of a dollar.

Eighty-cent wheat at present is just about double the distress prices of the autumn of 1933 and is in even more favorable relation to the extreme low prices for the crop, when farmers were dismayed and desperate and "farm relievers" were frantic and at their wits' end to find a scheme to help them. At that time, literally any plan which had even the ghost of a chance of boosting prices would have encountered open arms among the professional relief people.

Now, however, it is otherwise. Many farmers are in bad shape financially because the drought ruined all or a great part of their crops, still the per-unit price has been helped and the appearance of things are better for that reason. Consequently, the demand for "action" has somewhat died down.

The latest reports as to corn show that the yield for the United States will be probably slightly less than 1,500,000,000 bushels, the smallest in a generation. Indications also are that the per acre yield will be around 16

bushels, which will be the absolute lowest of record in this country.

Many outlying workers for the alcohol blending plan may not realize that the "big push" is off the movement and reports continue to indicate some activity, but the more powerful and influential interests are known to have changed their attitude.

Here then, is one spectre laid. But, it seems, there is always something new developing to cause worry and potential trouble. Unofficial but quite responsible and reliable word is that the trend of taxation is still on the upgrade and that taxes on motor fuels and motor lubricants, so important in aviation, are very likely to be increased instead of being decreased.

This in a way will have the effect of offsetting the good fortune evolving by reason of the elimination of gasoline blending, so far as economy is concerned. If gasoline blending had become compulsory, the probabilities are that fuel costs would have advanced substantially.

Of course, increased taxation is not a matter which would effect the human-life factor in such a way as alcohol-gasoline blending might have done in the manner outlined above, and to that effect the slackening of the blending campaign is a definite reassurance and saving which no amount of increased costs through other projects could erase.

Nevertheless, increased taxation is unwelcome to aviation and should receive considerable attention. Already the users of motor fuel are taxed far out of proportion to any other class.

The tax angle was one of the reasons why the proposed alcohol-gasoline blending project met with much opposition in various quarters. The feeling existed in a definite way that everything was being "taxed to death." Another important angle was that of the much-discussed matter of "personal liberty." The efforts of some to promote the project by compulsory means run afoul of the tenets of sound, constitutional government, it is held, on the theory that good government requires that there be no favorites and no felons. These observers have termed the scheme merely alcohol sales promotion.

"There is no serious objection to any citizen's use of alcohol as a motor fuel *in his automobile if he wants to*," is the way they put it. "If the users go into it with their eyes open and if they know everything involved, that is one matter. On the other hand, there are cases in which there might be very serious risks involved. And when it comes to forcing the use of a blended motor fuel of this nature upon the public, then that is a very serious matter indeed. It ignores the safety angle and it also definitely and clearly threatens both individual and industrial liberty."

It should be interesting to aviation friends in general to learn of developments of alcohol-gasoline blending in other countries than our own. For, let it be known, this is not just a domestic situation. There has been agitation for it in many lands and any interested in international flying projects would do well to take that condition in mind, for there are nations where such blends are being widely used and it is generally appreciated that the use of such a blend requires quite a little adjustment of motor fuel handling facilities in the engine when changing from a regular gasoline motor fuel.

As a result of a strike which effectively tied-up various forms of transportation in Panama City and environs the past summer, the government agreed to retail gasoline for 25 cents a gallon in Panama City and Colon for 45 days, after which negotiations for a definite settlement of the dispute will be resumed.

The government also agreed to postpone the placing into effect of the alcoholina decree. Under this decree the tax on gasoline unmixed with alcohol will be increased from 11 to 16 cents per gallon. Gasoline unmixed with alcohol will retail at 30 cents a gallon, while gasoline mixed with alcohol (to

(Concluded on page 328)

GLOSSARY OF WORDS, TERMS AND PHRASES—DIC-A-29

Aspect (Pterygoid). Appearance of a bird wing. An airplane wing in birdlike arrangement, that is, with the long dimension entering the air-stream.

Aspect-ratio. The ratio of the span to the average chord of a wing, or the ratio of the length to the average width. If (S) is the span or long dimension of the wing; and (C) is the chord or short dimension, then the aspect-ratio (r) becomes: $r = S/C$, or, $r = S^2/A$ where A = area.

Asphaltic Base Oil. A type of petroleum oil in which the predominating solid residue is ASPHALTUM. More correctly known as naphthenic base oil. Asphaltic base oils are found in the Southwestern and Gulf coast states, in Mexico and South America.

Asphaltum. A heavy black sticky semi-fluid, consisting largely of a hydrocarbon known as bitumen. It is obtained naturally from bitumen lakes in Central America or from the residue left after refining asphaltic base oils.

Aspirator. A device for creating a partial vacuum by means of a stream of water in a jet. Also known as a "filter pump."

Aspire. To move or soar into the wind. To make headway against the wind.

Astatic Couple. Magnetic needles of an electric measuring instrument so arranged that they are not affected by an external magnetic field.

Astern. At the rear of an aircraft.

Asymmetric. Not symmetric, unbalanced, off-center.

A.T.C. Abbreviation for APPROVED TYPE CERTIFICATE.

Atmosphere. (1) The blanket of air surrounding the earth. The aerosphere or terrestrial air. (2) A pressure unit equal to 14.7 pounds per square inch.

Atmospheric Air. Free air, or air taken from the surrounding atmosphere.

Atmospheric Electricity. The electrical charge carried by the atmosphere increases at an average rate of 300 volts per foot increase in altitude.

GLOSSARY OF WORDS, TERMS AND PHRASES—DIC-A-30

Atmospheric Gases. The atmosphere consists mainly of the two gases, nitrogen and oxygen. Also existing in the atmosphere are hydrogen, helium, argon, krypton, xenon and neon.

Atmospheric Height. The atmospheric blanket is variously estimated to extend from 50 to 150 miles above sea-level. No accurate figures have yet been obtained.

Atmospheric Inversion. A point in the atmosphere where the regular law of temperature decrease with altitude is suspended or reversed. Under some conditions, instead of decreasing with altitude, the atmosphere may locally increase in temperature for a short distance. The stratosphere is often called the "upper inversion" for the reason that the temperature ceases to decrease at this point and may even show a slight increase at higher points.

Atmospheric Pressure. The weight of the air causes pressure on surfaces immersed in it, proportional to the height of the air above the surface. The normal average pressure at sea-level is 14.7 pounds per square-inch, 2,116 pounds per square-foot or it will support a mercury column 760 millimeters (29.92 inches) in height.

Atmospherics. The so-called "static" or atmospheric electrical disturbances that cause roaring and crashing noises in radios in warm weather.

Atmospheric Temperature. Starting at sea-level, the temperature of the atmosphere decreases at the average rate of 3°F. per 1,000 feet, under normal conditions, until the temperature of —67°F. is reached at the stratosphere (approximately 36,000 feet). From this point and above temperature remains nearly constant or may increase slightly (upper inversion).

Atmospheric Visibility. Visibility is the distance at which prominent objects can be seen through a clear or hazy atmosphere.

Atom. The smallest portion of matter that retains definite characteristics. The atom itself is built up of small negative electrical charges called "electrons" and positive charges or "protons."

Elements of Fuselage Design

by DON BYRNE

Notes on the design and calculation of parasitic resistance of lightplane fuselage. This article contains material of great importance to the amateur designer.

THE design of the fuselage depends upon several factors.

For a slow- or medium-speed ship it is probable that most fuselages are of the flat-sided type, while the rounded short fuselage is best for high-speed lightplanes due to the reduction of parasite drag. Also, the tail-length, or the distance from the C. G. to the rudder-post, is longer in most cases with a flat-sided type than with a rounded type. This is because of the greater stability offered by the flat-sided body.

Smaller tail-surfaces (less area) are required in the case of a long body due to the greater leverage. The tail-length of the average lightplane ranges from 3 to 4 times the "mean chord," 3 being the more common tail-length ratio. Deep long flat-sided fuselages present a larger area behind the C. G. which also adds to the stability. This type of fuselage is simpler, less expensive, and easier for the amateur to construct and is well adapted to a cabin plane.

Such a design requires the vertical area to be 6 percent of the wing area—25 percent of the total vertical area for the fin, the rudder getting the remaining 75 percent. In this way the rudder area may be kept nearer the symmetrical axis (usually the datum line of the fuselage), to reduce the twisting moment on the fuselage.

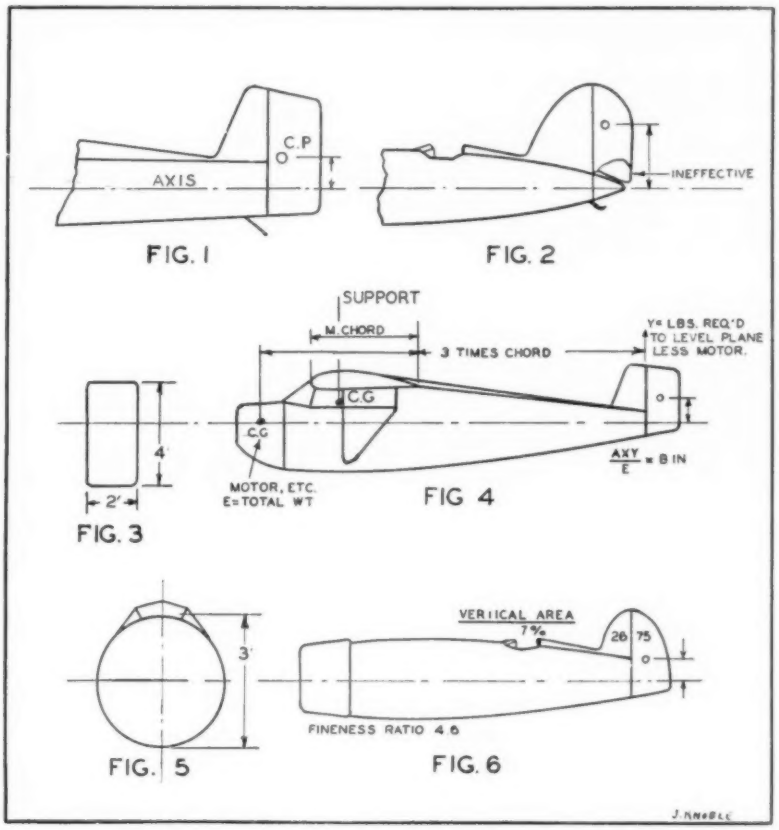


TABLE I

Area in sq. ft.	Coefficient in C values
10	0.001504
8	0.001489
6	0.001478
5	0.001471
4	0.001450
3	0.001413
2	0.001389
1	0.001364
.05	0.001337

In the case of the rounded type of fuselage, such as the Lockheed, the parasite drag is so much less than in the flat-sided type that this type should be employed, provided, of course, that the reader can afford and build a rounded type. The tail-length has been reduced to 2.5 times the "mean chord" in many instances with this type of fuselage. However, the usual tail-length of 3 is recommended.

Such fuselage require about 8 percent of the wing area to be the total vertical area. The fin and rudder are equal in size. The rudder area in this case is not kept near the symmetrical axis (see Fig. 1 and 2), and the twist on the fuselage is much greater. Unless carefully designed, a plane with a round fuselage is not quite as stable as the other type, but its advantages out-weigh this discrepancy.

Due to the more or less complicated structure of the rounded type, it is not advisable for the reader to try building a cabin plane out of this type, because there is not enough space in the average rounded fuselage to permit adequate movement. To show a comparison between the drag of the two types of fuselages, let us assume we are designing a fuselage of the flat-sided type being a single-place cabin plane.

(Concluded on page 336)

TABLE II

Aspect ratio	Area in square feet 10	8	6	5	4	3	2	1
24	.002030	.002010	.001994	.001985	.001957	.001907	.001875	.001841
20	.001985	.001965	.001950	.001941	.001914	.001865	.001833	.001800
18	.001955	.001935	.001921	.001912	.001885	.001836	.001805	.001773
16	.001916	.001898	.001884	.001875	.001848	.001801	.001770	.001739
14	.001872	.001853	.001840	.001831	.001805	.001759	.001729	.001698
12	.001774	.001757	.001744	.001735	.001711	.001667	.001639	.001609
10	.001724	.001708	.001696	.001688	.001664	.001662	.001594	.001565
8	.001684	.001657	.001655	.001646	.001624	.001582	.001555	.001527
6	.001645	.001637	.001625	.001618	.001595	.001554	.001527	.001500
5	.001624	.001608	.001596	.001588	.001566	.001526	.001500	.001473
4	.001594	.001578	.001566	.001557	.001537	.001497	.001472	.001445
3	.001579	.001563	.001551	.001544	.001522	.001483	.001458	.001432
2	.001564	.001548	.001537	.001529	.001508	.001469	.001444	.001418

Coefficients

Building the Epps Lightplane

by MANLEY MILLS

In this instalment, a complete description is given of the Epps fuselage and its connections. This is one of the most important elements of the plane and the description should be carefully studied.

THE first thing to do is to draw a full-size view of the side of the fuselage framework, representing the longerons and truss members by double lines spaced the right distance apart. Now, saw out a supply of wooden blocks about 1"x3"x¾", and nail these in pairs, one on each side of the members, about every 3 feet for the longerons, and a pair or two for holding each truss member. This will serve as a jig for holding the parts while they are being tack-welded together; later, each joint will be completely welded.

Cut the tubing carefully to size, filing the ends of the truss members so they will fit closely over the longerons. The latter are ¾"x20 ga., while the truss members are all ⅝"x20 ga. except the short ones at Sta. 1a, which are ⅝"x16 ga. The tail post is ¾"x16 ga., this gauge being used so the lower extension of the fin trailing edge will fit snugly into it.

After both sides have been tacked together, make a jig of the top view in the same manner as with the sides. Turn the sides upside down and place the upper longerons in the jig. Wood braces should be made to hold the sides vertical while the top truss members are being welded in. After tacking in the bottom truss members, place the fuselage on a pair of saw-horses and weld each joint completely, beginning at Sta. 1 and working backward in a clockwise direction to prevent warping.

The bracing in the first bay seems a bit complicated at first glance, but this is necessary because of the large number of struts going to this part of the fuselage. With the installation of the transverse diagonal bracing, the fuselage framework is completed. It would be a good idea to leave the seat until last.

The motor mount lugs are welded into slots sawed in the flattened end of the longerons. This is a highly important joint, so the best of welding is necessary.

Since it is necessary to get the landing-gear "V" lugs accurately lined up with each other, you should rig up some clamps or supports for holding them in the right position until welded. One way to do the stunt is to slip the lugs on a length of 5/16" tube or rod, using a sleeve 1" long between each pair to hold them the proper distance apart.

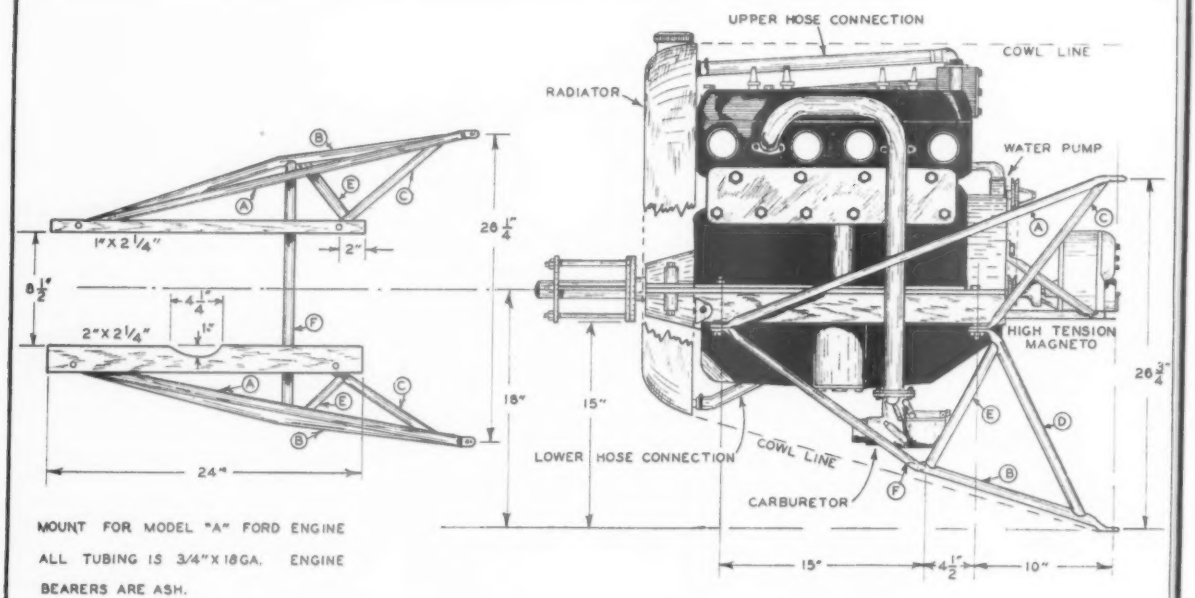
Then, space the pairs accurately on the tube or rod (23½" center to center), and clamp the rod to the longerons so the lugs will be at the correct angle. There may be other ways of doing it, but this method is just about as simple and accurate as any.

The center-section strut attachment fittings are made and welded on next. They are of 12 ga. material. Incidentally all sheet steel used is of the grade commonly known as SAE 1025, or cold-rolled medium carbon steel. The fittings are easily cut out and shaped with a hacksaw, drill, and files. Sharp edges likely to cut the cloth covering should be rounded off with a file.

Make the fittings for the upper end of the landing-gear shock struts next. The front and rear landing-gear "V" brace lugs may also be made and welded on at this time.

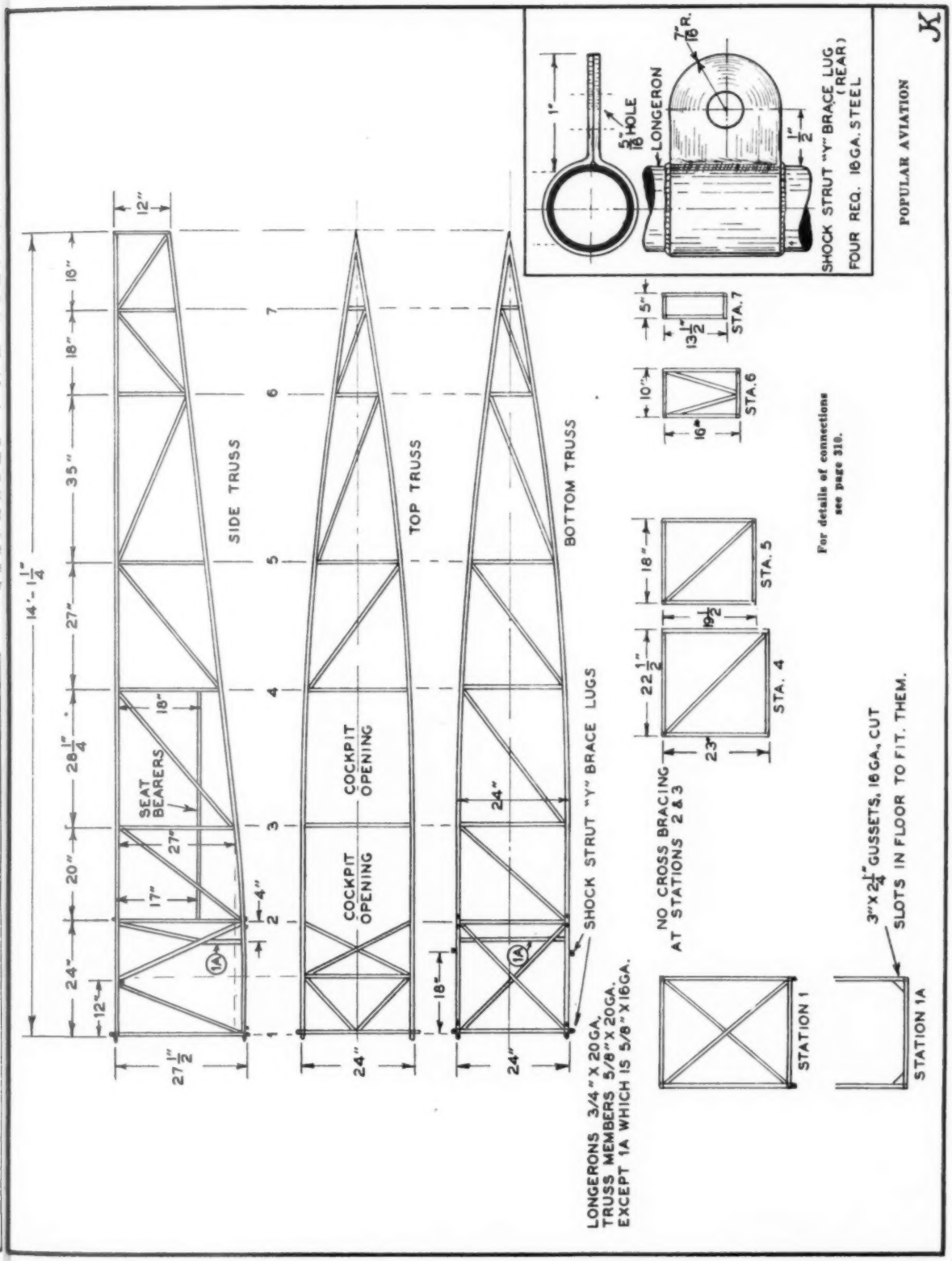
The lower wing attachment fittings should be made now. The front and rear ones are alike except the rear ones are shorter. The upper parts are bent to form an anchorage for the flying wires. In welding them to the fuselage, be sure to get them the correct distance above the longerons, as this determines the angle of incidence of the lower wing, which is 1½ degrees.

(Concluded on page 336)



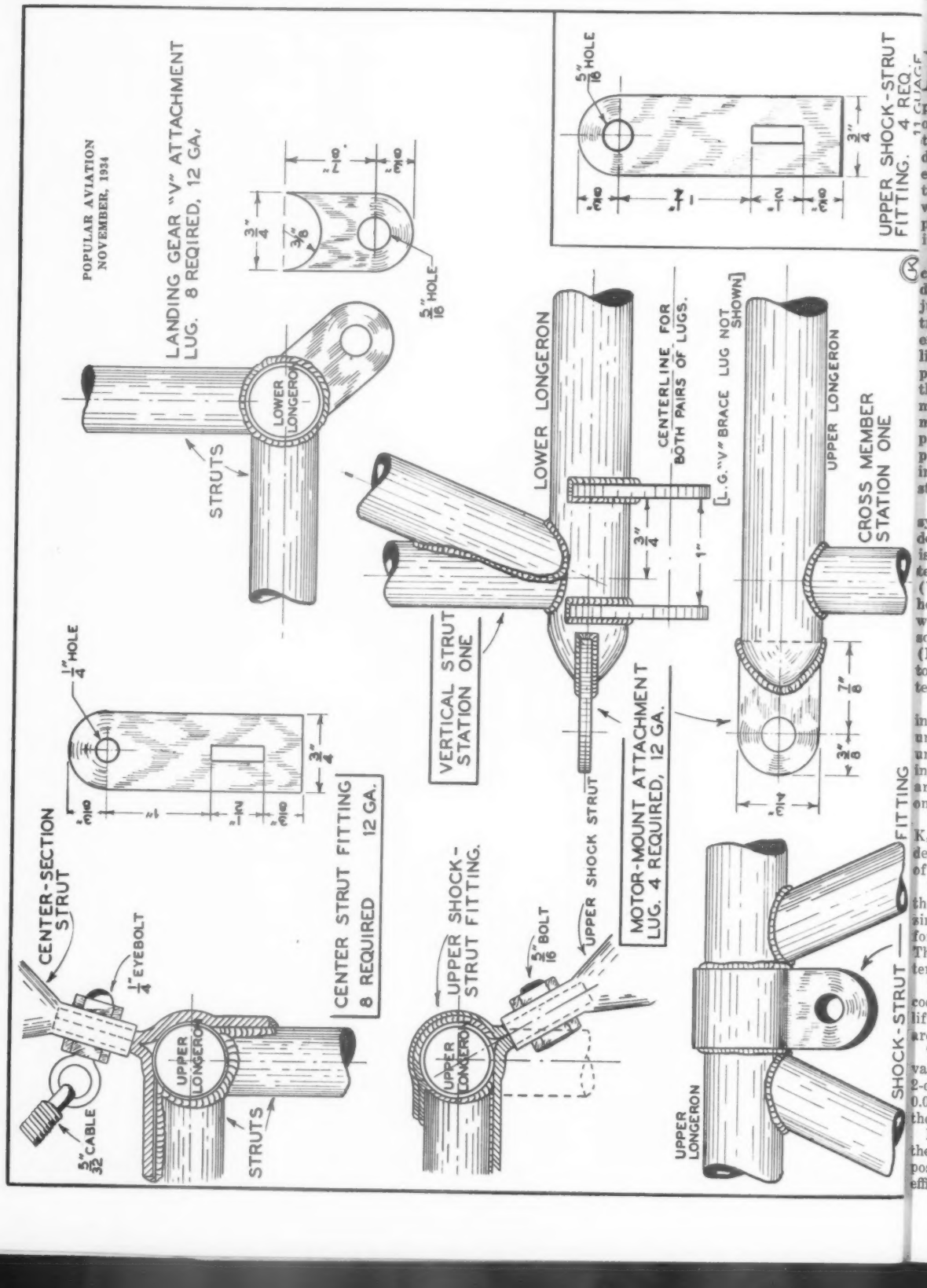
Details of the engine mounting on the Epps lightplane. It is designed for the Ford Model "A."

Layout of the Epps Fuselage



Details of Welded Connections

Details at the various stations on the fuselage. Note the station numbers and locations on the general layout, page 309.



Practical Lessons In Aviation

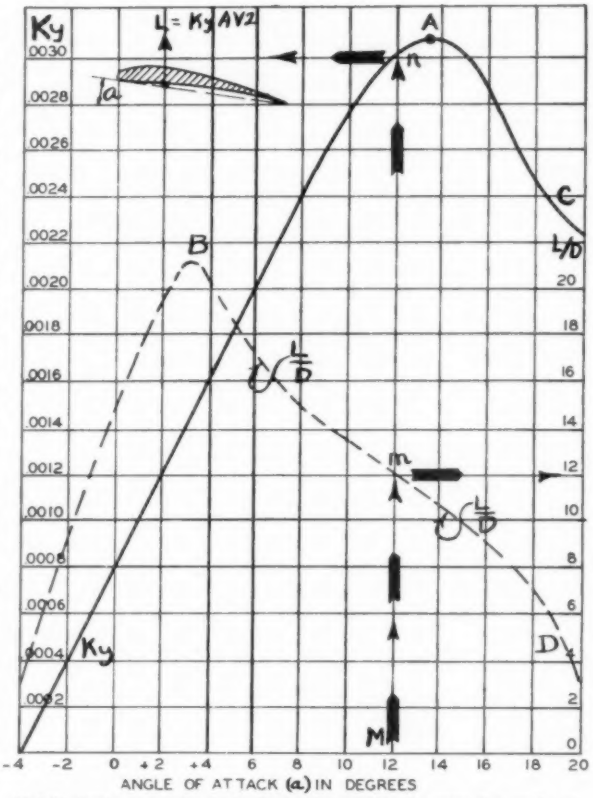
by JOHN B. RATHBUN

Further discussions on the subject of airfoils with reference to their elementary calculation and the use of airfoil charts and wind-tunnel reports.

IN the June issue of POPULAR AVIATION, we discussed the distribution of the pressures over the surfaces of an airfoil in flight and their effect upon the lift and drag. For those of our readers who have not a copy of the June lesson at hand, I will summarize the high points as a review and as an introduction to this lesson.

It is now time to ascribe certain values to the lift, drag and lift-drag factors just discussed. In this country it is the common, but not exclusive practice to give the lift and drag in terms of pounds, while the velocity of the airfoil through the air may be variously in terms of miles-per-hour (m.p.h.), feet-per second (f.p.s.) or meters-per-second (m.p.s.), depending upon which system of standard units is employed.

The oldest and simplest system for the student to understand at the present stage is the "Engineering Unit System," in which the velocity (V) is in terms of miles-per-hour, and the area (A) of the wing is given in terms of square-feet. The total lift (L) is in pounds, while the total drag (D) is also in terms of pounds.



Airfoil chart or graph which shows the relation between the angle of attack, lift-coefficient, and lift-drag ratio. A graph of this type shows the characteristics of a wing more clearly than figures.

Now, the basic unit for lift in the engineering system of units is the "lift-coefficient K_y." This unit (K_y) actually represents the lift in pounds given by an airfoil having an area of one square-foot at a speed of one mile-per-hour.

In the same way, the "drag-coefficient K_x" is the amount of drag obtained under the same conditions with an area of one square-foot at one mile-per-hour.

These coefficients also depend upon the angle of attack made by the airfoil, since the values of (K_y) and (K_x) vary for each different angle of attack (a). Their numerical value can only be determined by laboratory tests.

The greater the value of the lift-coefficient (K_y), the greater will be the lift under equal conditions of speed, area and angle of attack.

Thus, a certain airfoil may have a value of $K_y = 0.0004$ at an angle of 2-degrees and a coefficient of $K_y = 0.0032$ at 14-degrees or nearly ten times the lift at the greater angle.

However, owing to variations among the various airfoils, it is difficult or impossible to compute the value of the coefficient directly from the angle of attack (a). Each airfoil must be tested separately.

Taking the above values, we understand from them that the lift of an airfoil having an area of one square-foot will be 0.0004-pound at a speed of one mile-per-hour with an angle of 2-degrees, and that this lift will be increased to 0.0032-pound at an angle of 14-degrees at one mile-per-hour.

The area (A) in this case is the flat area of only one side of the wing. It is the same thing as the area of the shadow cast by the wing, or in other words its "projected area." In the case of a rectangular wing, 50 feet long and 8 feet wide, the projected area will be: $A = 50 \times 8 = 400$ square feet.

But it is the speed or velocity (V) that builds up the lift in leaps and bounds because the lift increases approximately with the SQUARE OF THE SPEED. The "square" of a quantity, you probably know is the product obtained by multiplying that number by itself—once. Thus, if the speed is 40 m.p.h., then the square of the speed is: $V^2 = 40 \times 40 = 1600$. In other words, flying the airfoil at 40 m.p.h., instead of one m.p.h., has increased the lift by 1,600 times!

Thus, if the wind-tunnel test data on a wing shows that one square-foot of its surface will give a lift of 0.0004-pound at one mile-per-hour, then the lift at 40 m.p.h will be: $1600 \times 0.0004 = 0.64$-pound per square-foot. At 100 m.p.h., the lift will become: $100 \times 100 \times 0.004 = 4.0$ pounds.

Now, we can build this calculation up into a simple formula giving the total lift (L) or drag (D), using the same symbols as before.

TOTAL LIFT $= K_y \times A \times V^2$ (1) or TOTAL DRAG $= K_x \times A \times V^2$ (2).

Just as an example, let us say that we have a wing with a projected area of 100 square feet, which is to be flown at 200 miles-per-hour. The lift-coefficient for this particular airfoil section, as found by the aerodynamic laboratories, shows that $K_y = 0.002$ at a given angle of attack. Then, we have:

TOTAL LIFT $= K_y \times A \times V^2 = 0.002 \times 100 \times (200 \times 200) = 0.002 \times 100 \times 40{,}000 = 8{,}000$ pounds.

The actual lift will vary somewhat from the above with various factors which can be corrected by methods described later on. Thus, the size of wing or "scale-factor" must be considered since the value of (K_y) was determined on a small model. The wing must also be corrected for aspect ratio, air density and several other quantities of like nature, but the computation above must stand for the time being until we progress farther in these lessons.

The drag can be computed in the same general way as shown by Formula No. 2, the only difference being that the value of (K_x) is substituted for (K_y). Let us say, for example, that the coefficient of drag (K_x) for this condition is given by the laboratory as $K_x = 0.0002$. Then:

TOTAL DRAG $= K_x \times A \times V^2 = 0.0002 \times 100 \times (200 \times 200) = 800$ pounds.

In other words, the propeller must exert a pull or thrust of 800 pounds to propel this wing through the air at 200 m.p.h. when it is carrying a load of 8,000 pounds. The lift-drag ratio in this case is: $L/D = 8000/800 = 10.0$.

With the above facts in mind, we

(Concluded on page 334)

The Gilmore Brothers Were Real Pioneers

WHEN fire swept the old hangar at Gilmore's Field, in Grass Valley, California, recently, it destroyed two aviation relics that should have been in the Smithsonian Institution. These were two early airplanes, the oldest of which was built in 1908. The most interesting features of these machines were the radical departure from standard construction that prevailed during that time.

Charlie Gilmore and his brother, Lyman Gilmore, enthused by the Wright Brothers' endeavors, decided to construct an airplane of their own design. They built a large cabin ship with a span of sixty feet and a length of forty feet. It was a monoplane with a wing, which faired back into a fantail. The rudder was at the rear of the fuselage and located underneath the wing. The wing itself was gull-shaped.

The Gilmore's, who operated a farm, put their hard earned savings into this huge ship with the hope of getting recognition for their advanced design. The silk for the wing alone cost over five hundred dollars. Not being able to obtain an engine of sufficient power, they constructed one of their own design which swung an eighteen foot tractor propeller.

The fuselage was a monocoque type with three windows and a door on each side. An old automobile steering wheel served as the "depth control" or stick. The pilot sat directly behind the engine, in the cabin, and except for the windows on each side, there was no visibility ahead. The wing was supported at the top of the fuselage, which was approximately twenty-five feet long, and also by ten struts on each side which were fastened to the bottom of the fuselage.

After much painstaking effort, the machine was finally assembled and to the surprise of the local natives managed to get a few feet off the ground on each of its trial runs. The lack of a suitable power plant prevented further efforts for the time being, so the Gilmore Brothers decided to use the engine in a new airplane.

A smaller two-seater, side-by-side cabin monoplane was then turned out. Better results were achieved with this machine which actually flew a little higher, but it could not get away from the airport which was tucked in the foothills of the high Sierra Mountains.

As the years progressed, these famous old planes were forgotten. Lyman Gilmore went away to other fields and Charlie Gilmore grew a beard. Rumor has it that he started it after putting the finishing touches on his first plane, and that he swore that he would never shave until the ship flew satisfactorily.

With Grass Valley just off the transcontinental air-line, the field was seldom visited by pilots, and those who did look in found a big barn, roof marked with the name of the little mining town, which was always locked and apparently deserted. They did not tarry long, and left without knowing of the priceless relics locked up inside of the "hangar."

It has been said that newsreel companies had made attractive offers to have the ships brought out and to have Charlie Gilmore explain them, but they were always turned down. It was Charlie Gilmore's hope that he would yet have them in the air, when the fire swept away all his work.

Whatever else may be said of the design, it was far ahead of anything that appeared for years afterwards, for at that time and up to the advent of the war, most of the airplanes were of a primitive type with the pilot sitting in the open. The cabin design was then apparently unthought of by others, and the monocoque construction of the fuselage was an innovation of its own. It is regretable that these airplanes were not preserved for the future as they were a part of early aviation.

And so, we have one more claimant entered in the pioneers' club.

END

GLOSSARY OF WORDS, TERMS AND PHRASES—DIC-A-31

Atomic Weights. The relative weight of the elementary atoms by which the weights of various compounds are calculated. Thus, the atomic weight of hydrogen is 1, oxygen is 16, carbon is 12 and so on through all of the elements.

Atomization. Spraying or breaking down a liquid into a spray of very fine particles. Gasoline is atomized in the carburetor before being vaporized on heated surfaces. Atomization differs from vaporization in the fact that atomization can be accomplished without the addition of heat.

Attack Airplane. A military airplane designed for action against ground troops. It is provided with several machine guns and small bombs.

Attack Angle. The angle made by the chord of an airfoil with the direction of the air-stream. See ANGLE OF ATTACK.

Atterissage. (French.) Landing on ground.

Audible. Sounds that can be heard.

Audibility-meter. A device for measuring the relative audibility of sounds or noises. The unit is the DECIBLE. Audibility differs from sound intensity for many sounds are more easily audible than more intense sounds.

Aureole. (1) A luminous ring or halo surrounding an object. (2) A ring of white light with a reddish border seen surrounding the sun or moon. (3) The rainbow colored ring surrounding a shadow cast above the clouds or on the clouds.

Aurora. Dawn. The rising of the sun.

Aurora Borealis. The Northern Lights. Luminous flickering radiations, beautiful luminous streamers and curtain-like pendants formed in the upper atmosphere in the vicinity of the northern magnetic pole. Probably due to the ionization of the upper atmosphere as such manifestations interfere with radio reception or electrical communications.

Auspufftopf. (German.) Muffler.

Ausströmungsoffnung. (German.) Exhaust port.

Autogiro. A heavier-than-air-craft sustained by a specially designed propeller or "rotor" with flexible blades, this lifting screw being driven by the translational air-stream caused by the forward movement of the machine. A vertical lifting component is thus produced which permits ascent and descent at a very steep angle (not vertical in still air).

Automatic. Self-operating or self-controlled.

GLOSSARY OF WORDS, TERMS AND PHRASES—DIC-A-32

Automatic-stabilizer. An automatic or self-controlled system for stabilizing an airplane or for controlling it in flight. In general, this is usually a form of gyroscopic device which operates the control surfaces in a manner similar to manual controls.

Automotive. Self-propelled or self-moving. Applied to any self-propelled vehicle such as a motor boat, automobile, airplane, motor-truck or tractor.

Autoplane. (1) A combined automobile and airplane. An automobile with wings. (2) An automatically controlled airplane.

Auto-rotation. The tendency for an airplane to continue rotating around its longitudinal axis when moving horizontally or diving. This tendency is involved in SPINNING of a plane.

Auto-stable. Inherently stable aircraft. Self-stable without the assistance of automatic stabilizers. This is generally made possible by the arrangement of the lifting and control surfaces.

Auxiliary. Assisting or corrective elements of a machine.

Auxiliary Surfaces. Secondary surfaces employed for balancing the main surfaces, for "trimming" or adjusting control surfaces, etc. Balancing surfaces for elevators and ailerons come under this definition.

Available Power. The power produced by an engine that is or can be directed to a useful purpose. This is not the gross maximum power, but the power remaining after all losses have been deducted.

Avalanch-wind. A violent gust of wind occasionally encountered in mountainous countries due to a slide of rock or an avalanche.

Avant. (French.) Fore or foreward.

Average. The average value of a number of quantities is equal to the sum of their values divided by the number of quantities. This is also known as the MEAN VALUE or the arithmetical mean.

Averse. (French.) Pouring rain.

Aves. Birds. Feathered vertebrates.

Avian. (1) A bird or belonging to the class of birds. (2) A steam driven airplane invented by Clement Ader and the first power driven full-size machine to get off the ground (without passengers) and fly for a short distance. First flight October 9, 1890.

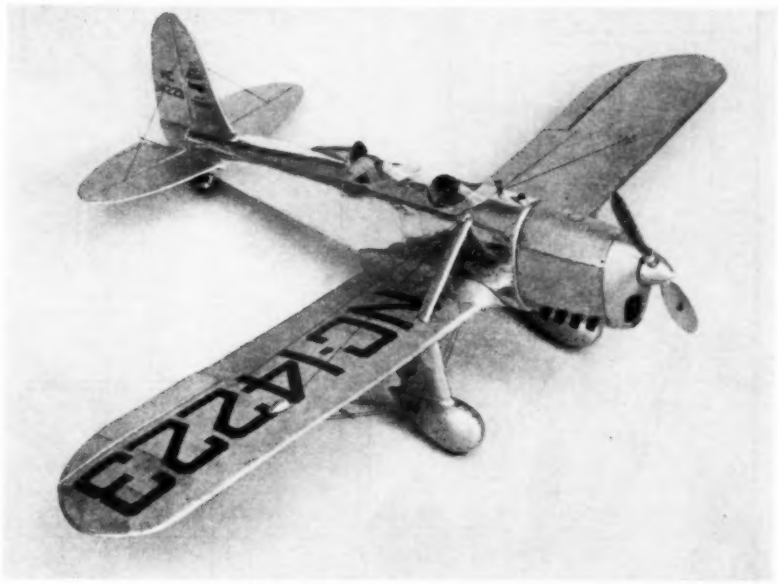
Aviatic. Pertaining to aviation or flying.

Building the Ryan Model S-T

by

PAUL W. LINDBERG

Model Editor and Designer for
POPULAR AVIATION



The completed model of the Ryan S-T glistens like polished silver when covered with aluminum foil. Note that the actual finish is aluminum and not red as shown on the cover.

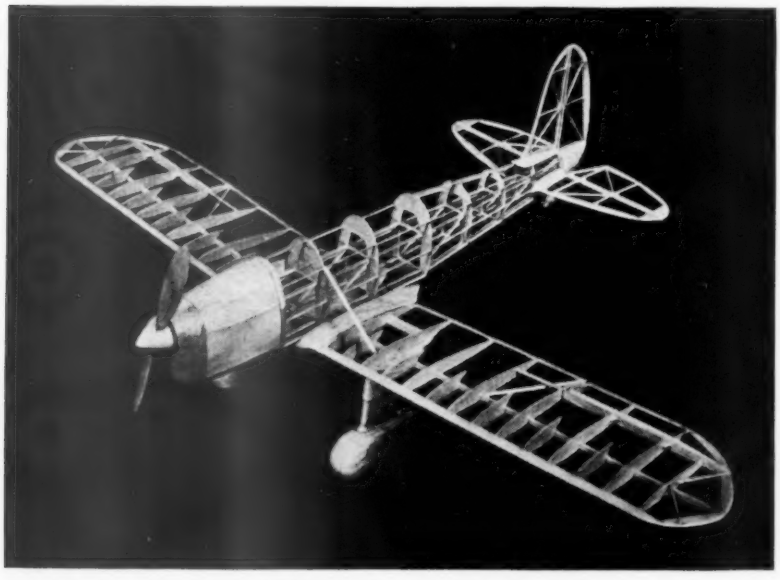
THE model of the Ryan builds into one of the trimmest little ships we have produced. You will be thrilled in watching this little model fly, as maneuverability can be obtained by adjusting all control surfaces, which carry aluminum hinges.

This is an excellent feature, developed only by our laboratory. This, together with concealed shock absorbers, new type of fuselage covering, with all the realistic rivet effects make it an outstanding model in the field.

All dimensions can be quickly and accurately determined by placing a ruler on the part to be measured. The plan is printed full size. If you wish a larger model, multiply this measurement by the amount of increase.

Color scheme. Entire ship is doped aluminum in color with the exception of fuselage which is covered with MASTER METAL UNIFOIL S-140 from section A-A to F-6. This unifoil is difficult to obtain in some localities, so for a limited time only P. A. Model Dept. will forward you enough of this material to cover the body on receipt of ten cents.

This is to cover cost of material, packing, and mailing. We are doing this as a special favor to our model builders. Address your letters to Paul W. Lindberg, Model Editor, in care of POPULAR AVIATION, 608 So. Dearborn St., Chicago, Illinois.



The framework of the Ryan Model S-T before covering, a photograph that will be of assistance when used in connection with the drawings.

CONSTRUCTION OF FUSELAGE

The fuselage sides are built from 1/16-inch square balsa. The longerons, verticals, diagonal braces, etc., are held in place until securely cemented, by inserting straight pins on either side of strips wherever needed, having first placed waxed paper on top of plan, to prevent parts from sticking to plan. After the two sides are completed, the cross members are cemented into their proper locations. Check carefully from front to rear for alignment.

Cut the formers from 1/32-inch sheet balsa and cement in their respective position shown on the plan. Cut-outs in formers are required to permit rubber motor to pass through body. F-6 is cut from ⅛-inch balsa to give strength at rear motor hook. Formers at section A-A are cut from ⅛-inch balsa and sanded to shape.

The position of the stringers is clearly shown on each former. The stringers are cut to short lengths and cemented in between the formers. If one is very careful formers may be notched to carry stringers in one piece from front to rear. The fuselage may be covered with tissue, but the amount of stringers must be doubled to compensate for shape of fuselage. We do not recommend this, as the fine appearance is lost when not covered with Master Metal Unifoil.

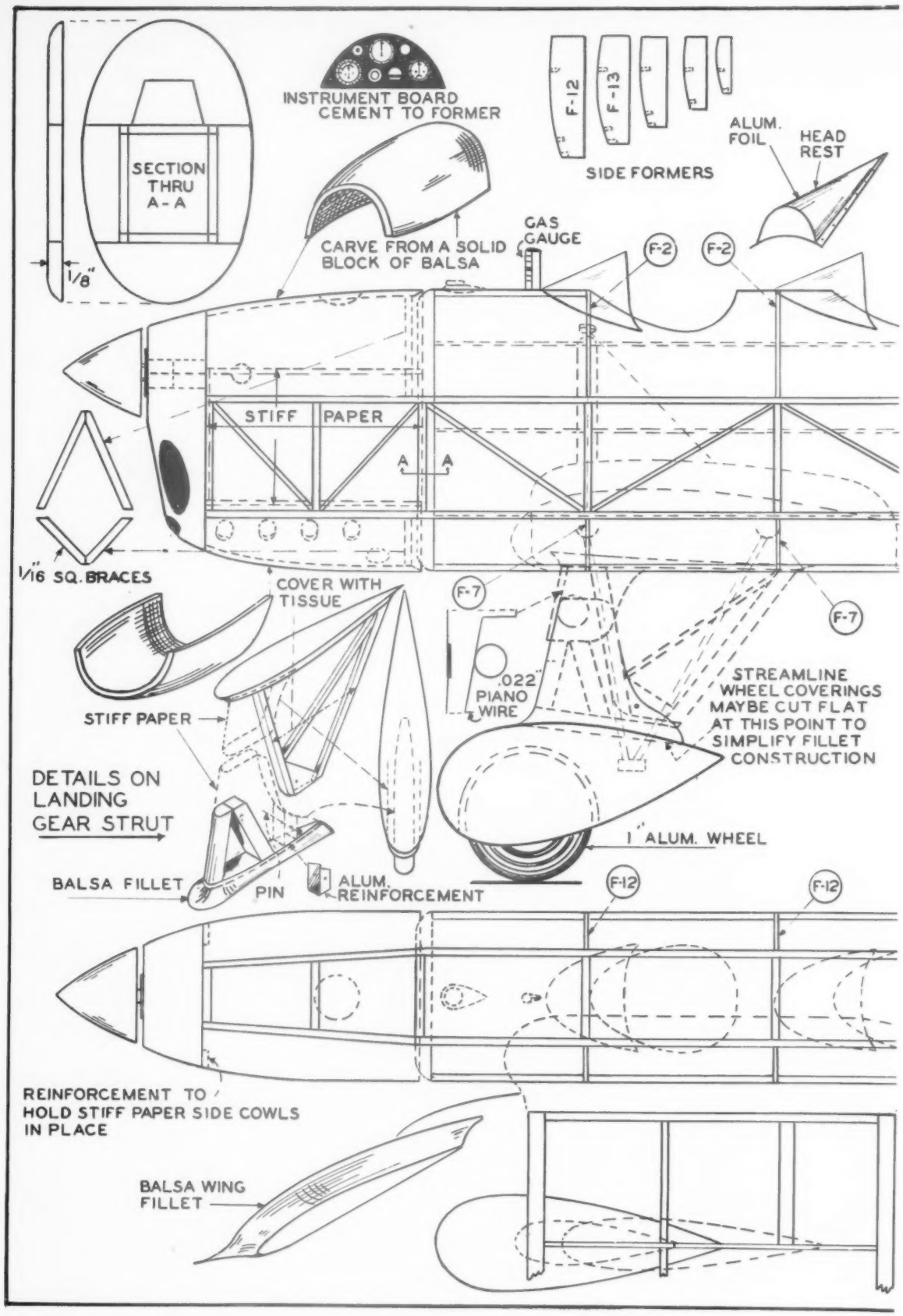
MOTOR COWLING

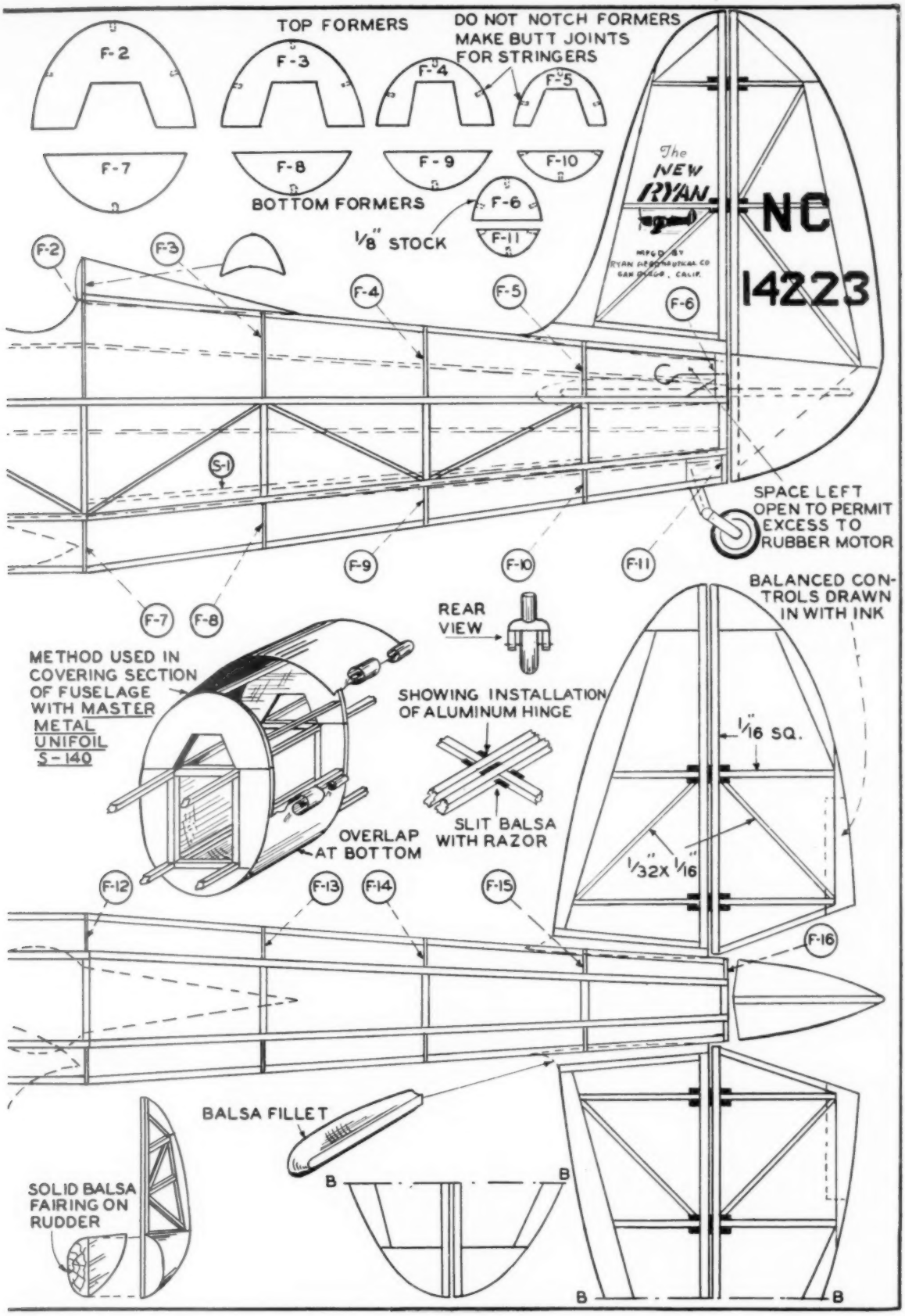
The front part of cowl is carved and sanded to shape from a balsa block. The top and bottom of cowl are hollowed out so that the walls are approximately 1/16-inch thick. The sides of cowl are made from a stiff grade of paper.

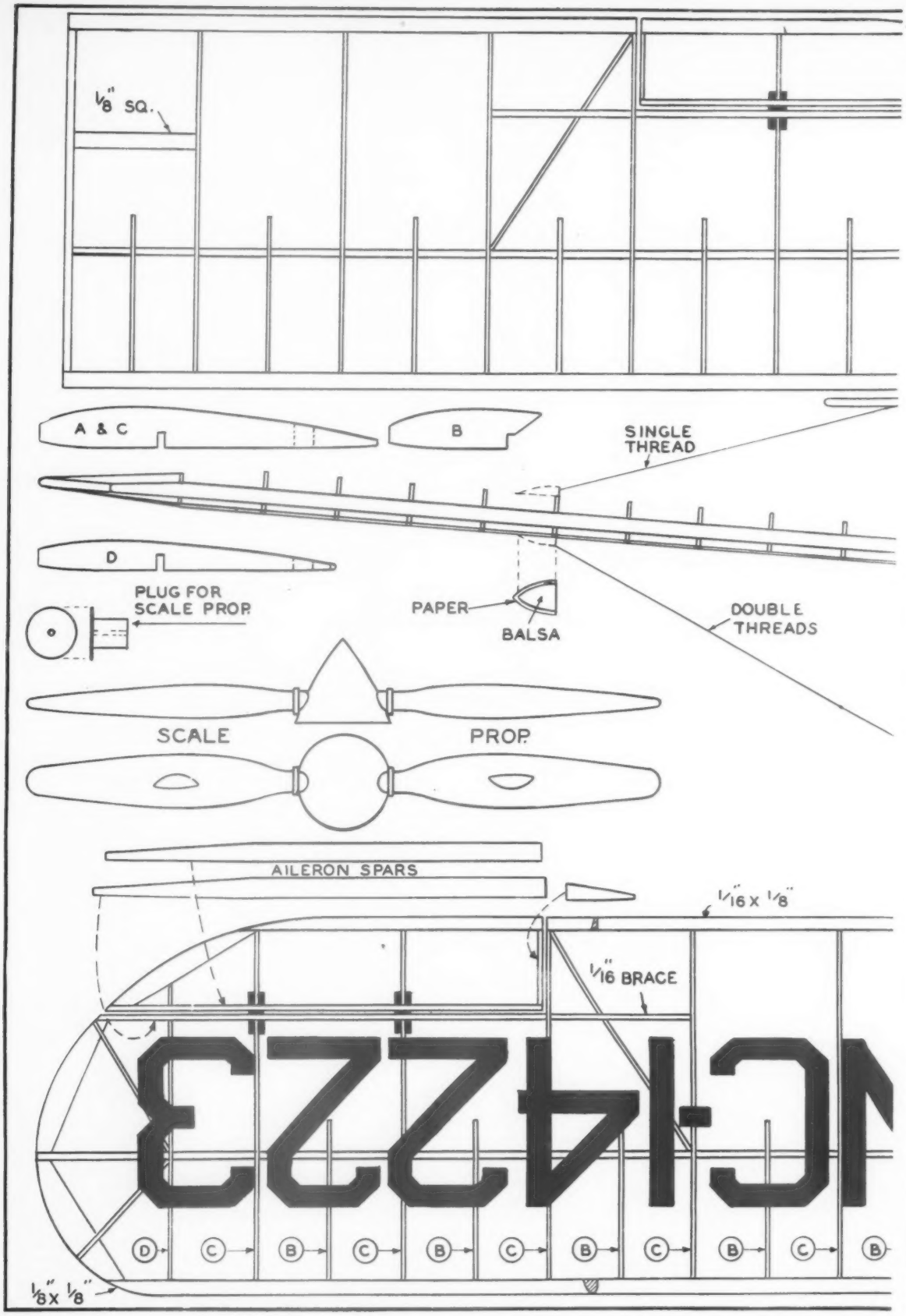
LANDING-GEAR

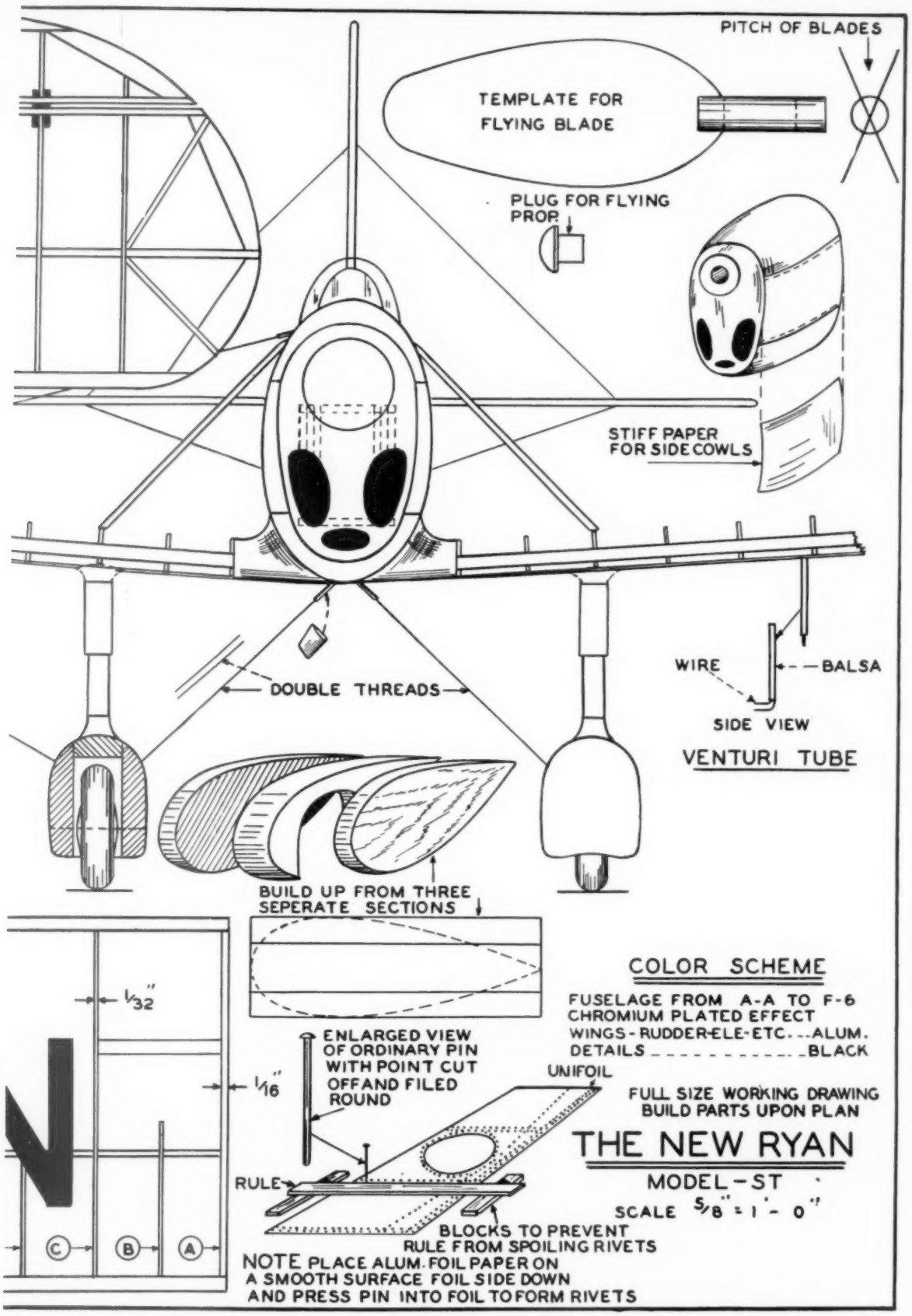
A strong grade of balsa is used in the construction of the landing-gear struts. Study perspective on plans and

(Concluded on page 323)


SECTION THRU A-A
1/8"
INSTRUMENT BOARD CEMENT TO FORMER
CARVE FROM A SOLID BLOCK OF BALSA
F-12
F-13
SIDE FORMERS
ALUM. FOIL
HEAD REST
GAS GAUGE
F-2
F-2
STIFF PAPER
A A
1/16 SQ. BRACES
COVER WITH TISSUE
F-7
F-7
.022" PIANO WIRE
STREAMLINE WHEEL COVERINGS MAYBE CUT FLAT AT THIS POINT TO SIMPLIFY FILLET CONSTRUCTION
STIFF PAPER
DETAILS ON LANDING GEAR STRUT
1" ALUM. WHEEL
BALSA FILLET
PIN
ALUM. REINFORCEMENT
F-12
F-12
REINFORCEMENT TO HOLD STIFF PAPER SIDE COWLS IN PLACE
BALSA WING FILLET


TOP FORMERS
DO NOT NOTCH FORMERS
MAKE BUTT JOINTS
FOR STRINGERS
F-2
F-3
F-4
F-5
F-7
F-8
F-9
F-10
BOTTOM FORMERS
F-6
F-11
1/8" STOCK
The NEW RYAN
NC 14223
MFG'D BY RYAN AERONAUTICAL CO SAN DIEGO, CALIF.
F-2
F-3
F-4
F-5
F-6
S-1
SPACE LEFT OPEN TO PERMIT EXCESS TO RUBBER MOTOR
F-9
F-10
F-11
F-7
F-8
REAR VIEW
BALANCED CONTROLS DRAWN IN WITH INK
METHOD USED IN COVERING SECTION OF FUSELAGE WITH MASTER METAL UNIFOIL S-140
SHOWING INSTALLATION OF ALUMINUM HINGE
1/16 SQ.
SLIT BALSA WITH RAZOR
OVERLAP AT BOTTOM
1/32 X 1/16
F-12
F-13
F-14
F-15
F-16
BALSA FILLET
SOLID BALSA FAIRING ON RUDDER
B
B
B
B


1/8" SQ.
A & C
B
SINGLE THREAD
D
PLUG FOR SCALE PROP.
PAPER
BALSA
DOUBLE THREADS
SCALE
PROP.
AILERON SPARS
1/16 x 1/8"
1/16" BRACE
D
C
B
1/8" x 1/8"


PITCH OF BLADES
TEMPLATE FOR FLYING BLADE
PLUG FOR FLYING PROP
STIFF PAPER FOR SIDE COWLS
DOUBLE THREADS
WIRE
BALSA
SIDE VIEW
VENTURI TUBE
BUILD UP FROM THREE SEPERATE SECTIONS
1/32"
1/16"
ENLARGED VIEW OF ORDINARY PIN WITH POINT CUT OFF AND FILED ROUND
UNIFOIL
RULE
BLOCKS TO PREVENT RULE FROM SPOILING RIVETS
C
B
A
NOTE PLACE ALUM. FOIL PAPER ON A SMOOTH SURFACE FOIL SIDE DOWN AND PRESS PIN INTO FOIL TO FORM RIVETS
COLOR SCHEME
FUSELAGE FROM A-A TO F-6 CHROMIUM PLATED EFFECT
WINGS - RUDDER-ELE-ETC. ... ALUM.
DETAILS ... BLACK
FULL SIZE WORKING DRAWING BUILD PARTS UPON PLAN
THE NEW RYAN
MODEL - ST
SCALE 5/8" = 1' - 0"

What the Industry is Doing

Latest bulletins from the airplane, engine, equipment manufacturers and dealers boiled down into a nutshell. Contributions to this department are invited.

PARKS AIR COLLEGE, E. St. Louis, Ill., announce the purchase of two new Kinner primary training planes and a new Model YKC Waco 4-place cabin plane equipped with a 225 h.p. Jacobs engine. This is a noteworthy addition to an already very complete school fleet at Parks Air College.

IF PLANS can be worked out, K.L.M. Royal Dutch Air-lines will enter two planes in the MacRobertson International Air Race, a Fokker Type F.XXXVI or F.XXII in the handicap section of the race and a Douglas DC2 in the speed race.

CAPT. CHARLES R. BOWERS, chief instructor in the Bendix Aviation Ground School, is a U. S. Army reserve pilot and has specialized in airplane maintenance work. He began to fly prior to 1910 and was an instructor during the war. This school is maintained for the benefit of the employes of the Bendix Products Corporation, South Bend, Ind.

WESTPORT MFG. COMPANY, Glendale, Calif., has developed a light weight and compact dynamotor which eliminates the necessity for "B" and "C" batteries on aircraft radio receivers. Complete with filter, the Westport dynamotor weighs less than 7 pounds and measures 7 in. x 6 in. x 3 in. overall. It can be mounted in any convenient position and requires only one cable, the conventional "B" battery line.

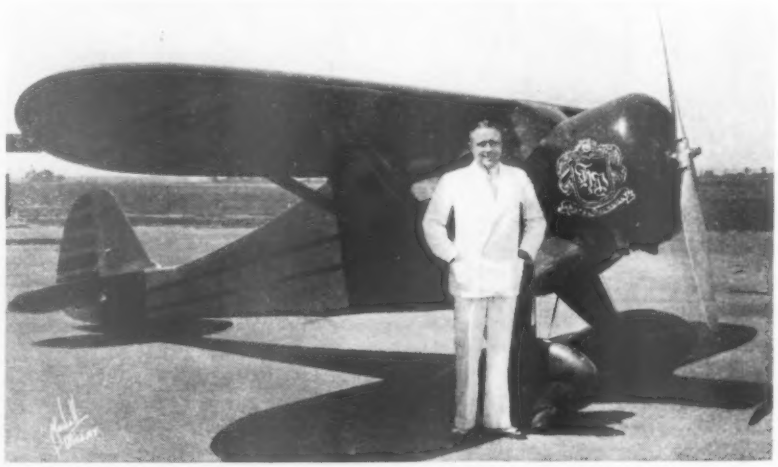
A GUIDE to the fabrication of stainless clad steel has just been issued by the Ingersoll Steel and Disc Company, 310 South Michigan Ave., Chicago. Its 16 pages take up, step by step, the various methods of soldering, lock-seaming, riveting, deep-drawing, pickling and heat treating stainless clad steel in full detail. This is a very comprehensive book which should be in the hands of manufacturers and engineers.

OXWELDING Corrosion Resisting Steels is a new publication by The Linde Air Products Company, 205 East 42nd St., New York, N. Y. Very valuable information on welding stainless steel is contained within the 8 pages of this booklet based upon the comprehensive investigations of Union Carbide and Carbon Research Laboratories, Inc.

SEAPAK sound and temperature insulation has been used throughout the cabin of the new Vultee transport plane and Lockheed has recently adopted the material for the insulation of cabin planes. Seapak, consisting of kapok in a flexible sheet, is manufactured by the Seaman Paper Company, Chicago, Ill.

SIL-FOS is a new low temperature brazing alloy having a low melting point. It contains silver as an important ingredient and the joints made with it are actually stronger than the parts joined. It is extremely fluid and penetrates deeply into the metals to be joined.

SOCONY-VACUUM OIL CO., INC., New York, N. Y., has purchased a new Beechcraft plane which will be shipped to Europe on the Europa. It will be lashed on the deck where it may be viewed by the passengers. Henry J. White, Aviation Sales Manager of the Socony-Vacuum Oil Co., Inc., accompanied by W. L. Faust, will tour Europe in the new plane.



John H. (Jack) Wright standing beside his Super-Scarab Monocoupe which he has souped-up and entered in the MacRobertson races. Whether this ship wins or not, lightplane fans will be astonished by its performance.

AIRPLANES are being used in Edmonton, Alberta, Canada, for distributing poisoned food to grasshoppers. Their figures show that four pounds of the poison are required per acre, which costs between $8 and $10 per section.

UNITED AIR LINES passed its 70,000,000-mile mark this summer, about 33,000,000 of this distance being flown at night. It is expected that about 15,000,000 miles more will be flown during the rest of 1934, which is equivalent to the total mileage flown during the United's first three years of operation.

GENERAL AIR LINES suffered a loss of $53,000 since last May when the new airmail contracts were issued by the government. The cancellation of the day passenger-express flight between Los Angeles, Las Vegas, Nevada, and Salt Lake City is the result of these losses. A second reason for the cancellation of the flight is the fact that a recent act by the government increased the pilots' wages by 10 percent.

THE MECHANICS Division of the Roosevelt Aviation School moved out to Roosevelt Field, Mineola, N. Y., is now in its permanent quarters at Unit No. 1.

FLEETWINGS, INC., which has been doing business at Roosevelt Field, Mineola, N. Y., for the past five years, is now preparing to move into its own plant at Bristol, Pa. Fleetwings has purchased the old Keystone plant with some 35 buildings on the property, including a hangar, office and main factory. It is planned to maintain service facilities for amphibians and seaplanes in addition to its manufacturing operations.

SAFAIR, INC., received a contract to fly New York newspapers to Newport during the period of the yacht races.

ADMIRAL BYRD radioed for some more canned vegetables and soup. The items will be flown to him by plane during the last leg of the journey.

THE ANNUAL meeting of the International Acetylene Association will be held at the William Penn Hotel in Pittsburgh on November 14, 15, 16. There will be many technical sessions that will be of interest to everyone interested in the art of welding.

BUREAU OF AIR COMMERCE has announced that it has amended the regulations governing the installation of boundary lights around airports, so that smaller and less expensive lamps can be used throughout the night.

WESTPORT MFG. CO., Glendale, Calif., has developed a long range radio compass which enables itinerant pilots to find their way directly to any broadcast station. This radio compass consists of an indicating dial mounted in the cockpit, a conventional Westport aircraft radio receiver and a compass converter unit. There is also a dynamotor and a loop antenna mounted in the fuselage. The complete assembly weighs less than 45 pounds. If the plane is headed directly toward the station, the indicator registers "zero." If the plane is off its course, ever so slightly, the needle points RIGHT or LEFT as the case may be.

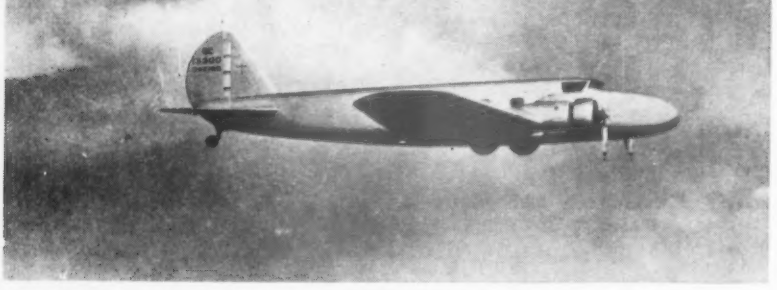
FRANK C. HART, president of Hartol Products Corp., New York, N. Y., has recently purchased a 5-passenger Beechcraft to enable him to cover his business territory quickly.

THE GLIDDEN COMPANY, Cleveland, Ohio, has put an absolutely new product on the market called "Glidair Fabricote" for airplane fabrics. This is a rejuvenator of checked or cracked airplane fabric which increases the life of the fabric for many months after its application. The fluid softens the old finish, causing the edges of the cracks to amalgamate, it tautens the fabric and gives a good finish for the application of the final finish coats.

A PILOTS' aviation picnic and barbecue was held at the Grand Central Terminal, Glendale, Calif. More than 1,200 pilots and airplane owners were invited, and the general public was invited to the transport show for which there was no charge.

RALEIGH, N. C., dedicated its new $250,000 airport on October 4. This new plant is probably the best in the South and among the best in this country.

THE WACO AIRCRAFT COMPANY, Troy, Ohio, showed net sales of $544,705.86 for the last six months, or a net profit of $25,433.05 for this period.



This is the Boeing 247D entered in the MacRobertson Races by Roscoe Turner and Clyde Pangborn.

ANOTHER HONOR FOR IDEAL SUPER DETAIL PLANES

TESTED & APPROVED BY JUNIOR BIRDMEN OF AMERICA MODEL PLANE INSTITUTE SER. NO. ONE

JUNIOR BIRDMEN OF AMERICA
NATIONAL HEADQUARTERS—1854 BROADWAY
NEW YORK CITY

July 31st, 1934.

Mr. David Newark, Vice President,
Ideal Aeroplane & Supply Co., Inc.,
22-26 West 19th Street,
New York City.

Dear Mr. Newark:

Through Mr. Irwin Polk, Supervisor of our Model Plane Institute, I am pleased to learn that your Stinson model is the first to be approved by this organization, and I am most happy to pass this information on to you.

Junior Birdmen Seal of Approval, bearing serial No. 1 is being sent you for use on the carton, instruction sheets, etc., of the Stinson model.

This model has been found to be almost 100% perfect as a result of our various laboratory and field tests, and I feel sure you are continuing this splendid effort in the construction of your other kits and aviation products.

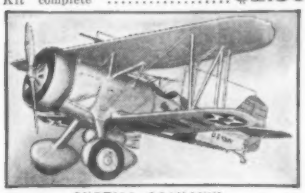
Very truly yours,
Lawrence Shaw
Junior Birdmen of America
National Director & Chief of Staff

First to be Approved

...by Junior Birdmen

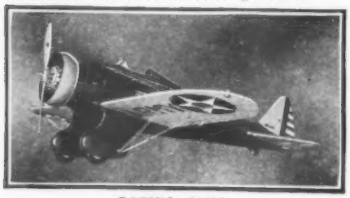
STINSON RELIANT

Wingspan 32 5/16", length 21¼", weight 3½ oz., exact ¾" scale. Here's a plane you'll be mighty proud to own and fly. An exact reproduction of one of the latest 4 passenger cabin planes. You'll find more unusual and different features in this plane than in any other. For example—adjustable speed arresters built into the wings, the movable cabin doors, the complete interior with four seats and control column, and all the other Super-Detail features. Colored in bright contrasting yellow and black.
Kit complete **$2.50**



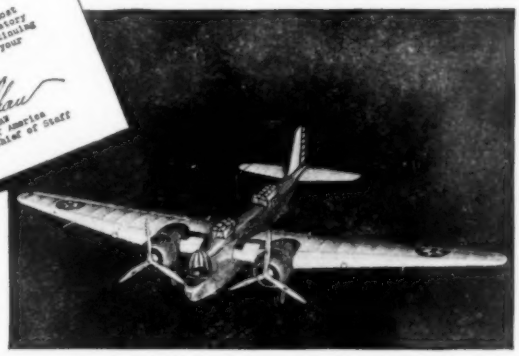
CURTISS GOSHAWK

Wingspan 23⅜", length 16¾", weight 3⅜ oz., exact ¾" scale. You've heard of this beautiful Curtiss Goshawk. Now you can build your own with the most complete kit you ever saw. This snappy little Navy fighter has many more details than you can see in the photo. Everything designed in exact scale of course. Streamlined drag ring specially designed; two detachable blade propellers, and the entire model coated with the new IDEAL high lustre finish, with silver, yellow, red and black coloring. Plenty of material is furnished.
Kit complete **$2.00**



BOEING P-26A

Wingspan 21¼", length 18", weight 2½ oz. Exact ¾" scale. One of the newest, most advanced of all fighting planes. Fast, speedy, with full armament capable of over 240 miles per hour. This flying model is an exact replica of the famous fighter—one that is identical in all but size with its noteworthy big brother. Beautifully colored in olive drab and yellow. All Super-Detail parts included.
Kit complete **$1.75**



New Super-Detail Martin Bomber

Exact ½" Scale

Wing span 31½", length 22⅛", weight 4⅝ oz. This famous big, powerful mystery ship of the Army now comes to you in exact ½" scale, a beautifully designed olive drab and yellow **IDEAL** Super-Detail Model. Has more new and beautiful features than any model plane you ever saw—one of the most complete flying models ever built. In addition to cockpit-operated controls and other standard Super-Detail features, the MARTIN BOMBER has retractable landing gear, rotating gun turret, movable machine guns, special streamline cowlings, two types of 3 bladed propellers—one for flying and one for exhibition; with removable motor sticks for flying; Rudder and elevator balanced surfaces. New type freese ailerons—all in all one of the finest flying models ever built. Order yours today with the coupon.. **KIT COMPLETE**..... **$3.50**

First to be approved—found to be almost 100% perfect in every detail—the famous IDEAL Stinson Reliant. This big beautiful flying model came away with the honors—and that's the way every IDEAL Super-Detail model is built, to come out on top.

No wonder IDEAL models take the lead. They are 100% scale—laid out by experienced flying men—men who have spent their lives designing and building real planes. That's why IDEAL Kits are accurate, complete, perfect, exact in every detail. That's why you really learn the principles of aviation when you build and fly an IDEAL Super-Detail model.

Whether you build the New Martin bomber shown above, the Stinson Reliant, the Curtiss Goshawk or the Boeing, you get the same high quality workmanship, the same accuracy in detail and 100% scale reproduction with every construction feature of the original duplicated and in the exact proportion, so that the finished plane not only flies beautifully, but it gives you a strikingly handsome, precise and perfect flying model.

BOYS! MAKE BIG MONEY BUILDING PLANES

There is a big demand for IDEAL Model Planes. They are extremely popular for decorative purposes in the home. Sporting goods stores dealing in aviation supplies, drug stores, jewelry stores, and toy stores all want them for display purposes and to place in stock. They are beautiful in windows or on counters, they help to advertise the store and attract attention to the windows.

You can sell finished IDEAL Planes to gas stations dealing in aviation oils; rent or sell them to department stores for special sale or sales in the sporting goods departments. You can also rent or sell them for decorative purposes to aviation associations, lodges, and club rooms. The possibilities for selling finished planes are almost endless.

FREE FOLDER —Send also for the new IDEAL folder showing the latest model IDEAL Planes. It contains valuable information on how you can make real money by building and selling these famous flying models.

DEALERS: You can make more money with IDEAL products. Write for details of more than 100 model airplanes & ship models

See your local dealer or send this coupon

WHAT THE SUPER-DETAIL KIT INCLUDES:

Everything necessary to build a big, beautiful workmanlike job is included in the Super-Detail Kit. Finest materials only are used in its construction: Sheets of selected plainly printed balsa, strips of various sizes, etc., sheets of silk tissues, cement, both colored and plain dope, propeller shafts, two propellers, motor plate, rubber motor, wheels, cable cord and all other hooks, pulleys, control hinges, eyelets, washers, sand paper, celluloid, reed, wire and other small but necessary things to make the complete model exactly in accordance with the plans and instructions.

IDEAL AEROPLANE & SUPPLY CO., INC.

22-26 West 19th Street, New York, N. Y.

Pacific Branch:
Model Boat & Aircraft Co., 1356 Fifth Ave., San Diego, Calif.
Canadian Branch:
Canadian Model Aircraft, 3007 St. Antoine Street, Montreal.

IDEAL AEROPLANE & SUPPLY CO., INC.
22-26 W. 19th St., New York City
Please send immediately the items I have checked below. I am enclosing $..... (West of Denver 25c extra. All planes postpaid.)

Martin Bomber ☐ $3.50 **Curtiss Goshawk ☐ $2.00**
Boeing P-26A ☐ $1.75 **Stinson Reliant Airliner ☐ $2.50**
Free folder with information ☐

Please print name.....
Address .....
City .....**State**.....

Patents

(Continued from page 284)

view of "prior disclosures." The particular features of Mr. Smith's device covered by the European patents are therefore commercially of no value.

3. Two other claims were rejected on "Brown in view of Jones," which means that if some of the elements of Brown's invention were joined to some of the elements of Jones' invention, they would produce in combination a device similar to that of Smith.

4. Smith's application was partially "in interference" with a pending application of another inventor; that is to say, this prior application claimed in substance practically the same device as did Mr. Smith. It was clearly shown by the Patent Office that this pending patent had priority over Smith's application in the matter of the filing date as well as the date of conception of the idea, these facts being corroborated by sworn statements and witnessed data antedating the affidavits made by Smith by several weeks.

The attorney was thereby compelled to cancel a number of claims in order to avoid the interference. As a result of the above-named rejections, Mr. Smith's patent contains only three none-too-strong substitution claims which cover minor improvements in combination with elements already patented, these improvements being thereby "dominated" by prior patents.

Consequently, if Mr. Smith were to manufacture his device he would be certain to infringe in one way or another on some prior patent, to say nothing of the pending patent with which he was in interference. Needless to say, the approached manufacturer declines to consider Smith's proposition which, after all, would only involve him in a litigation.

Mr. Smith by this time realizes that his vaunted "patent" does not amount to a row of pins. Not being devoid of common sense, he also realizes that, poor as the results may be, his attorney has done his best to get something for his client and he clearly took the case on the assumption that Mr. Smith was thoroughly familiar with all phases of his particular line of endeavor.

It is not the patent attorney's business to pass on the merit of any invention from a technical standpoint, nor can he be expected to spend his time digging to find out "a prior" whether the devices submitted by his clients will be successful from a patent standpoint. The attorney's proper function is that of a link between the inventor and the Patent Office; his responsibility is confined to the preparation and prosecution of his client's application and ends with the allowance of the patent. If his client's invention lacks originality, all the attorney can do is to try and effect a compromise, but he cannot guarantee results.

Clearly, the cause of the failure should be ascribed to Mr. Smith's erroneous interpretation of the term "invention." The Patent Office defines this term as "a novel improvement on the prior art," and it is incumbent upon the inventor or his attorney to clearly and unequivocally establish this attribute of novelty by means of a full disclosure of the invention supplemented by claims which specifically define the novel improvements on or novel divergence from inventions previously disclosed.

Very evidently, Smith was not familiar with the "prior art," and being pre-occupied with the technical aspects of his invention he entirely neglected to avail himself of the simple means, which are practically at everybody's disposal, to ascertain whether his idea was patentable or not. As to the above-mentioned means, the following suggestions are offered:

a. BOOKS, PERIODICALS, CATALOGUES AND OTHER PUBLICATIONS.

The inventor, or rather the would-be inventor, should systematically read up on the subject, starting with recent editions and working back as far as the publications allow. In this work he should include allied subjects as well without adhering too closely to the specific device he has in mind.

He will thereby gain a comprehensive view of the trend of development of his particular field and will gradually discern the reasons why this development has progressed along certain lines in preference to other lines which may appear equally feasible. An analytical study of these reasons will carry him into the economic aspect of his proposition.

b. PRIOR PATENTS.

The fact that nothing has been manufactured or published along the lines he has been working on, does not necessarily mean that his idea is original with himself and has never been thought of before, or that it has never been patented. Many patents lie dormant after issue without ever being developed or applied. In the United States, a patentee is not obliged to manufacture or commercialize his invention within a certain length of time from the date of issue, as is the case in at least one foreign country.

In many instances, the sole purpose of a patent is to prevent further developments by competing concerns or individuals. For this reason many patents are simply bought up and shelved without being actively exploited. This is a sound and sensible policy, but is rather apt to baffle the efforts of the free lance inventor who bases his conclusions as to the novelty of his device on what he has observed in actual practice.

The obvious course for him is to make a thorough investigation of the patent situation before he starts to develop his idea. This method was followed by the late Thomas A. Edison, and it should be noted that as a direct result all his inventions were commercially successful.

The inventor can compile a list of patents pertaining to the kind of device he has in mind from the yearly indices of the United States Patent Office Gazette, available at any public library. The patents noted should then be looked up in the monthly volumes of the Gazette which gives the main illustrations of the inventions and one or two of their most characteristic claims.

These searches, of course, do not reveal the existence of any pending patents, and if the inventor feels justified in applying for a patent, he would still take a chance on running into an interference. Interferences, however, are of comparatively rare occurrence.

Many inventors, like our Mr. Smith, seem to be under the impression that it is absolutely necessary to reduce their inventions to practice before applying for a patent. If the inventor, however, feels sure, on the strength of his patent investigation, that his fundamental idea is right, he would do well to apply for a patent right away. Since invention begets invention, he will very likely hit upon improvements in the course of constructing his device; he may even invent something superior to his original conception. Such developments should immediately be taken care of in a subsequent patent-application.

As an example of the futility of spending time and money on inventing a device that will be absolutely dominated by prior patents, we would cite the case of an inventor who contrived a highly ingenuous and original apparatus for adjusting the slat of a slotted wing. The device could only be claimed as an integral part of a slotted wing or in combination with the movable slat or auxiliary wing.

The device, by itself, without the slotted wing would be useless; on the other hand the slotted wing can get along very well without his particular device since the Handley-Page patents are fundamental and cover any number of ways for moving the slat in and out. This is just one example out of many aeronautical patents that illustrates the principles just described. It is the basic principle of the "patent fence."

So far as independent manufacturing is concerned, the commercial possibilities of this new device are therefore nil, since the inventor would immediately render himself liable to action for infringing the Handley-Page patents. As for trying to make a deal with the owners of these patents, the chances of coming to an agreement would be extremely slender, for the Handley-Page Co. would undoubtedly continue to use their own devices in preference to somebody else's device which they would soon improve on anyway. So what would be the use?

There is much that can be said on the subject of patents and inventions, too much for the scope of this article. A good point to keep in mind is that a successful invention is one percent inspiration, nineteen percent preparation, and eighty percent perspiration. Go to it.

END

"I Have Inspected Many C-D

planes and have at last concluded that you excel in detail and construction. The models also have fine flying characteristics. I enclose this Boeing order with a feeling of complete satisfaction before I receive your Kit because of the statements above"

states a N. Y. customer. So when you, too, want the best—order a C-D Kit.

Authentic '32

HOWARD "IKE"

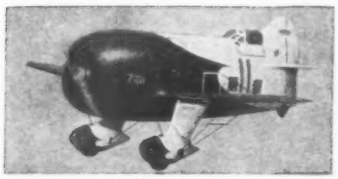
Information on this design is supplied both as the four- or two-wheeled "Ike," and the two-wheeled "Mike." The model flies and climbs beautifully at a fair rate of speed—in practically the same manner as our older well-known "Pete." The model has a span of 15⅝", has a length of 13⅞" and weighs 1.5 oz. Colored entirely white with black details, lettering. Complete 198-piece printed wood. Kit **SF-42**, postfree, only **98c**

Couldn't be beat at any price.

Redesigned

'17 FOKKER D-7

Our well known D-7 model has been redesigned into this authentic steady flying beauty and so beautifully colored that it looks as though it were drawn right from the ranks of one of the famous German "Flying Circuses." Wings taper beautifully, new feature control movements (not from cockpit), scale propeller, authentic Spandau guns, pilot block (you make all)—and printed out wood. Very beautifully colored international orange, green, white, black details. Span 21⅛", length 17¼", wt. 3.5 oz. Kit **SF-15B** complete, postfree.....**$2.50**



'32 GEE-BEE — Doolittle's supersportster. Span 18½", length 13⅜", weight 2.7 oz. White with red scalloping, black details. Super complete kit—printed out wood. Kit **SF-27**, only.....**$1.75**

Latest ARMY MARTIN BOMBER

Another C-D realistic masterpiece! An authentic high speed flying model of the famous mid-wing bomber—the plane that's still on the secret list—claimed fastest service bomber in world—Army again ordered 46—10 used in U. S. to Alaska cross-country trials, called one of the most difficult and hazardous flying trips ever undertaken—only a Martin could be entrusted to the job—the only really efficient substitute mail plane. Span 53", length 35¼", weight 17 oz. Colored standard U. S. Army yellow, olive drab, details black. Novel and strong method of duplicating an almost impossible landing gear (but not retractable). Complicated fillets beautifully (and easily) duplicated. Nothing ever before like it—even our Boeing 247. Has printed out wood—an enormous quantity—all strips necessary. Turned balsa invisible hub wheels. By simply removing motor spars (the time-proven efficient method of multi-motor powering) model is ready for exhibition. All other necessary material, such as strong tissue, celluloid, hinge wire, M.W., large quantities of dopes, wood and paper cement, insignia, rubber, turned cowl fronts, stout axle material, striping tape, etc., hundreds of pieces, considering all wood printed out. If sold 5 or more years ago, would easily command at least **$20.00**. Shipped express collect, 10 lbs. (not C.O.D.)—ready for shipment approximately Sept. 25th—order yours now! Complete (giant) Kit **SF-45**, only.....**$6.50**

Approx. 10 lb. charges to N. Y. C. 58c; to West Coast $1.40. Incidentally no kit prices shall be lowered. If any change takes place, it will be an increase. Order now!

BOEING P12-E—Span 22½", length 15⅝", weight 3.2 oz. Printed out wood. Colored yellow and olive drab, with beautiful red and yellow trimmings. Complete Kit **SF-8C**, postfree, only **$1.75**

"Prompt mailing service and quality make your company one of the best I have ever patronized. I was thoroughly satisfied with the Kit I recently purchased." Detroit, Mich.

"Although I have had only two of your models, a Boeing F4B-3 and a Waco C, I am convinced that yours are the best to be had." Youngstown, Ohio.

King of Large Distance Models--**BOEING 247**

Span 55⅝", length 38½", wt. 16 oz. Colored all silver. A Super-complete Kit—119 pieces, including many 36" balsa sheets and strips, tapered "nose" pieces for wings, large special balsa wheels with bronze bushings, drilled aluminum tail wheel pieces, turned balsa end rings, C-D standard steel type slotted and drilled flying propeller hubs, all necessary dopes and liquids, over 20 sq. ft. of full size superdetailed C-D drawings and photos, and all other special material needed. Complete (giant) Kit SF-35 (shipped "express collect" only—recipient to pay 7 lbs. shipping charges when delivered)—originally sold at $6.50—now only $4.95

'33 BOEING F4B-3—Span 22½", length 15⅝", weight 3.2 oz. Silver, yellow, red. NOW HAS PRINTED OUT WOOD. Super-complete. Complete Kit **SF-29**.....**$1.75**

'32 DOUGLAS O-38—Span 30", length 22¾", weight 4.8 oz. Yellow, olive drab, black details. Printed out wood, 2 men, etc. Complete Kit **SF-43**, only.....**$2.75**

Printed Out Wood in all these Kits except SF-31, 32 and 35. All contain blocks for carving pilot heads.

'33 AERONCA C-3 Span 27", length 15¼", weight 1.9 oz. Red and silver. Printed out wood. Complete Kit **SF-40 $1.75**

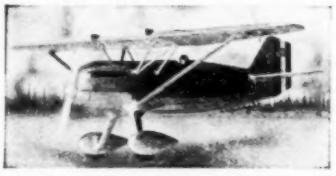
'33 CURTISS F9C-2 Span 19¼", length 15⅜", weight 2.2 oz. Silver, blue, red and black. Printed out wood. Complete Kit **SF-22B**, only..**$1.75**

'32 SUPERMARINE S6-B Span 22", length over all 21⅝", weight 2.9 oz. Will R.O.W. Silver and blue. Kit **SF-19**, only....**$1.75**

All Photos On This Page Are Of Our Own 2" Flying Models

'31 BAYLE'S G-B Span 17½", length 12", weight 2.1 oz. Yellow and black. Printed out wood. Complete Kit **SF-17B**.....**$1.50**

'33 GR. LAK. SPORT TR. Span 20", length 15¼", weight 2.1 oz. Cream, orange. Printed out wood. Complete Kit **SF-1C**, only.....**$1.75**



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'32 HALL RACER Speed flights. Span 19½", length 13⅜", weight 2.6 oz. Red and black. Complete Kit **SF-31** for only.....**$1.50**

'32 LINCOLN SPORT Light plane beauty. Span 15", length 12⅛", wt. 1 oz. Cream and black. Complete Kit **SF-36, only 98c**

'30 HOWARD "PETE" Span 15", length 13¼", weight 1.5 oz. All white. Printed out wood. Complete Kit **SF-18B, only 98c**

'32 BOEING P26 Span 21¼", length 17⅞", weight 2.5 oz. Yellow and olive drab. Printed out wood. Complete Kit **SF-23**.....**$1.75**

'30 BOEING 95 MAIL Span 33¼", length 24¼", weight 3.5 oz. Blue and natural. Complete Kit **SF-32**, only.....**$1.50**

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IN ORDERING—send check, M. O. (if cash, register). Remember—every parts order, regardless of how small, MUST be accompanied by 15c packing charge, insurance 5c per order. No C. O. D.'s on any order. Special delivery 15c each extra for Kits under $2.00. Over this, on 2 or more Kits, 25c. (Canada and England: Add 10% all orders, except SF-35 and 45; other countries 20%.)

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The giant BELLANCA BOMBER will appear in colors on the front cover.

Good News Regarding the December Issue

THE December issue of POPULAR AVIATION will contain many articles of particular interest and value to our readers.

In addition to the many popular departments and special features already well-known to our readers, will be a new and valuable department that we have had in view for some time. When you see it, you will be as enthusiastic over its future as we are—and that's a whole lot.

For our many readers interested in commercial aviation, we are starting a series of informative articles on the various departments of a commercial airline. Dr. Alexander Klemin will conclude his popular series of articles on sound-proofing which have attracted the attention of the aviation world.

Then there will be a biographical sketch of Glenn H. Curtiss, probably the greatest name known in early aviation development, the practical lessons in aviation will be resumed, the construction of the Epps lightplane will be concluded and there will be an instructive article on the cause and cure of wing flutter. You cannot afford to miss this issue.

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Ryan S-T

(Continued from page 313)

note how rear part of strut fits into front strut, so that it will move freely where pin passes through aluminum reinforcements. Stiff paper around upper and lower part of struts should be fitted several times to make sure the parts will not bind against each other. The shock absorber spring should be installed and rear part of strut covered with tissue before cementing in the pieces of stiff paper. The stream line wheel coverings which are built up in three sections are carved and sanded to shape from a soft grade of balsa.

CONSTRUCTION OF WINGS

Cut all ribs from 1/32-inch sheet balsa. Pin center spar in position on the plan, next cement ribs in their proper locations. The leading and trailing edges are now cut and sanded to shape and cemented to front and rear of ribs.

Make wing tips as shown on plan of 1/16-inch balsa. We recommend this type of wing tip, as it is far simpler to construct and neater in appearance.

ELEVATOR AND RUDDER

These are clearly explained on plans and no trouble should be encountered.

FINISHING DETAILS

The fuselage is now covered with the unifoil. We advise making templates for each section to be covered. Lower rear from F-7 to F-11 to S-1 in one piece. The top from F-2 to F-6 to S-1 all in one piece. Note all rivets are pressed in unifoil before applying to framework. The remaining three sections are also covered with unifoil using a separate piece for each section. After the wings, elevators, etc., have been covered with tissue, shrink with a coat of water. Let stand until dry, then dope. Other small details are clearly explained on plans.

END

Big Race

(Continued from page 287)

there will not be enough time left to construct the ship so Ammel has withdrawn his entry.

A Northrop Delta with a Hornet engine has been listed as an entrant to be flown by Lieut. Marshall Lindholm of the Swedish air force, while another woman entry, Mrs. Louise Thaden, will take delivery shortly on her Beechcraft A71-F, a standard Cyclone powered cabin biplane.

It is quite interesting to note that commercial passenger transport planes will compete on an equal footing with the lighter types.

Glancing through the above imposing array of American aircraft, there is little doubt left in one's mind that it will be one of these ships that comes out of the race course's treacherous country far ahead of the few foreign-built ships that have any chance at all of placing in the money.

END

SELLEY'S LATEST !!! SUPER VALUE

AFTER ALL THERE IS NO SUBSTITUTE FOR QUALITY

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These new models are sensational in their flight performance. Flights over 300 feet are GUARANTEED with these snappy, LARGE, long-distance flyers.

GUARANTEE If You Are Not Satisfied Your Money Will Be Refunded

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WITH RING MOUNT
1¼" long B 25c
1¾" long A 30c

SWIVEL TYPE GUNS C
2" Double Action....15c

PURSUIT TYPE GUNS D
¾" long.....5c
1" long.....5c
1¼" long.....5c

TYPE F
1¼" long....10c

TYPE E
1¾" long....15c

DUMMY RATCHET GUN
⅞" long....10c

Bombs and TORPEDOES

13/16" 5c
1¼" 10c
3" Torpedo ..15c

Dummy Motors New Detailed Cast Motors
1" dia.. 9 cyl. 30c
1⅛"dia. 9 cyl. 50c

Postage 3c each

EACH KIT COMPLETE WITH FINISHED SAW-CUT PROPELLER

Knife Cut Balsa
Printed Balsa
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Colored Jap Tissue
Wing Adhesive
Music Wire
Celluloid
Cement
Rubber
Bamboo
Reed

50c Each

POSTAGE 10c

FULL-SIZED PLANS, building instructions and everything to build a complete model.

Send For Yours NOW!

HOWARD RACER "PETE" 18" Wingspan

HAWK P6-E 15" Wingspan

VOUGHT CORSAIR 15" Wingspan

ALL 50c EACH

PROPELLERS

Hawk Type 2-bladed		Hawk Type 3-bladed		Standard 2-bladed		Standard 3-bladed	
3¼"	25c			1½"	10c	1½"	10c
4"	30c	4"	35c	2½"	15c	2½"	15c
4½"	35c	4½"	45c	3¼"	20c		
5"	35c	5"	50c	4"	25c	4"	30c
5½"	40c	5½"	60c	4½"	25c	4½"	40c
6¼"	40c	6¼"	70c	5"	30c	5"	45c
7"	55c	7"	80c	5⅛"	35c		
				6"	40c	6"	60c
				6½"	45c		
				6¾"	55c		

Propellers can be had in Alum. Alloy Castings up to 12"—Larger sizes are finished up to 24" diameters. Send for catalog.

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Adjustable Pitch Aluminum Propeller

Suitable for Flying Models

2-bladed		3-bladed with Shaft	
8" dia.	35c	9" dia.	$1.00
10" dia.	50c	11" dia.	1.25

Special Shaft & Hangar Threaded shaft with soldered arc flange....20c

Patented

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RUBBER TIRED WHEELS

Aluminum Disc Rubber Tired Tail Wheels

½" dia.	5c ea.
⅝" dia.	6c ea.
¾" dia.	7c ea.
⅞" dia.	8c ea.
1" dia.	9c ea.
1⅛" dia.	10c ea.
1¼" dia.	11c ea.

SEND FOR CATALOG

Balloon Tire Alum. Disc

1½" dia.	25c pr.
1¾" dia.	28c pr.
2" dia.	30c pr.

Bal. Tired Cel. Disc Wheel

1½" dia.	30c pr.
1¾" dia.	33c pr.
2" dia.	35c pr.

Aluminum Disc Rubber Tired Air Wheels

1" dia.	18c pr.
1½" dia.	20c pr.
1⅞" dia.	25c pr.

Treaded Rubber Aluminum Disc

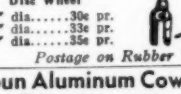
1⅜" dia.	30c pr.
1½" dia.	40c pr.
2" dia.	50c pr.
3" dia.	60c pr.
5¾" dia.	$1.25 pr
6½" dia.	$2.00 pr
7" dia.	$2.50 pr

Swivel Joint Fork and Axle

½ up to ⅝" wheel	10c
¾ up to ⅞" wheel	15c

Postage on Rubber Tired Wheels, 4c

Spun Aluminum Cowls



Dia.	Drag Ring	Open Face	Closed Face
1"	15	15	15
1½"	18	18	18
2"	20	20	20
3"	28	28	28

Postage 6c

PICTURES

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Puss Moth
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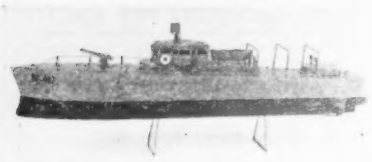
U. S. SUB-CHASER SC-437

An actual working model--20 inches long



Do not confuse with solid wood models as this is powered with a heavy duty spring power plant that drives twin propellers through a midget gear transmission.

SC-437 INSTRUCTO-CRAFT KIT $2.75 P.P. includes a completely finished and water-proofed hull, spring motor, keel, rudder, propellers, propeller shafts and gear drive parts. It also includes main deck, forward and aft cabins, pilot house, life boat, 6 die cast ventilators, naval gun, crow's nest, life preservers, brass railing and port hole fittings.
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Postage prepaid on orders over 50c. Under 50c, add 15c. No stamps. West of Mississippi, add 10c. Canada, add 15c. FREE LIST.

Dealers—Clubs—Schools Write for Wholesale List

18 IN. LENGTHS	**CLEAR CEMENT**
1/16x1/16 ....75 for 5c	1 oz. bot. 5c
1/16x⅛ .....35 for 5c	2 oz. tube 10c
⅛x⅛ .....30 for 5c	½ pt. 35c
⅛x¼ .....10 for 5c	**CLEAR DOPE**
¼x¼ ..... 5 for 5c	1 oz. bot. 5c
⅛x½ ..... 2 for 5c	½ pt. 30c
18 IN. SHEETS	**COLORED DOPE**
1/32 & 1/16x2. 8 for 10c	1 oz. bot., all colors 5c
⅛x2 ..... 6 for 10c	**JAPANESE TISSUE**
¼x2 ..... 3 for 9c	1 doz., all colors ... 19c
18 IN. PLANKS	**SHEET CELLULOID**
1x1 1 for 4c 2x2 1 for 18c	6x8 ..5c 12½x16 .. 20c
1x2 1 for 10c 2x3 1 for 23c	**CELLULOID WHEELS**
BAMBOO	⅜"..pr. 5c 1⅝"..pr. 16c
1/16x1/16 ....36 for 5c	1"...pr. 7c 1⅞"..pr. 17c
1/16x¼x15 .... 1 for 1c	**THRUST BEARINGS**
WOOD VENEER PAPER	1c each. 10 doz.
20x30 ..... 1 for 10c	**WIRE**
RUBBER	2 ft. 1c 25 ft. 10c
1/16x1/16 .....18 ft. 5c	**INSIGNIA SHEETS**
⅛ flat .....15 ft. 5c	24 and stripe 5c
PROPELLER BLOCKS	**WASHERS**
⅛x¾x6 ..... 6 for 5c	1 doz. ⅛x¼ 1c
¼x 1x7 ..... 3 for 5c	**BUSHINGS**
¾x 1x8 ..... 3 for 5c	1 doz. 8c
¾x1¼x12 .... 1 for 4c	**REED**
1x1¼x12 .... 1 for 7c	2 ft. 1c
SHEET ALUMINUM	**BIRCH WHEELS**
.005 in. thick, 15c sq. ft.	½"...pr. 3c 1"...pr. 4c
.010 in. thick, 20c sq. ft.	¾"...pr. 3c 1¾"...pr. 5c
	1¾" .....pr. 10c

20 IN. FLYING PLANS 10c—3 for 25c
Texas Sky Chief, Sparrow Hawk, Boeing P-12-F, Gee Bee, Boeing Trans. 247, Spad Chass., Vought Corsair, Curtiss Swift L. W., Fokker D-7, Waco Cabin Bi-plane, S. E. 5, Fairchild 24, Douglas Dolphin.

IMPERIAL MODEL AERO SUPPLY
416 McDONALD AVE. BROOKLYN, N. Y.

Airy Chat

(Continued from page 276)

ing pioneer in British aviation and who built the wartime planes bearing his name.

But Mr. Sopwith is now following his original hobby. He built and sailed racing-yachts and motor boats long before he took up aviation—in fact, his interest in aviation was the direct outcome of his original experience with boats. He was a wealthy English sportsman to begin with, and the great Sopwith aeronautic industries grew out of which was formerly only a love for outdoor sports.

Unlike Sir Thomas Lipton, who built five of the previous contenders in this event, Sopwith will sail his own yacht—the Endeavour. This, of course, adds to the interest in the race which is not ordinarily an epoch in the lives of aviation fans.

* * *

WITHIN the last few days we have received many letters from persons prominent in aviation to the effect that we were unfair with the Bureau of Air Commerce and were unjustly nagging and belittling them and their work. And, since all of the letters display the same trend of thought, it would seem that the protests were instigated by some central body, more particularly in view of the fact that all of these letters were received within such a short period of time, yet our alleged mud slinging has been conducted over several years.

But the curious part of the whole performance is that we are accused of nagging and picking on the Bureau without giving any reason for our stand. They say that we have been dealing out insinuations, intimations and inuendos without giving a specific reason for our criticism. And the writers all broke down with this same idea at the same time—just like an epidemic.

This has touched us deeply for we thought that we had labeled each howl very carefully and clearly. We ran a whole "Howl Department" devoted to this cause for over a year and it would seem that someone could grasp the idea we were promoting in a total of fourteen issues. In an early issue we are planning to publish a complete review that will leave no doubt in the minds of our readers regarding our attitude towards the D. of C.—both good and bad.

* * *

WELL, the old investigating committee down in Washington is still hammering away at Gen. Benjamin Foulois, Chief of the Air Corps. To those who have followed the political news in the papers for the last 30 years, this should at once indicate to the public that Gen. Foulois is an unusually capable and efficient man.

Our big politicians, who were alone responsible for the army airmail fiasco, are busily pushing the blame over on the honest and sincere Chief of the Army Air Corps. They are trying, by any means possible, to elect Foulois the official goat for one of the most outrageous proceedings ever pulled off in Washington. But our hope, and the hope of the personnel of the Air Corps, is that Gen. Foulois will defeat his persecutors and retain his present job. We need him.

* * *

MEBBE, next year, they'll be trying to frame some other Chief of the Air Corps for the current political monkey business. Someone will then have to explain why the officers' yearly flight time was cut to 125 hours and why so many competent air officers were retired.

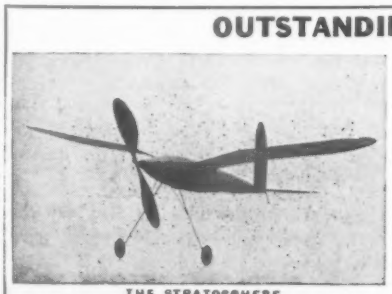
* * *

HELEN S. WATERHOUSE, the "flying reporter," was another welcome visitor. She travels all over the country by air and collects some fine material on the subject of aviation and on lighter-than-air craft in particular. She is re-writing some of Van Orman's diary, which will be of great interest.

* * *

CAN YOU imagine an efficient air-force of a major nation restricting its flight personnel to 125 hours' flying time per year? Well, that's the present

OUTSTANDING FLIGHTS



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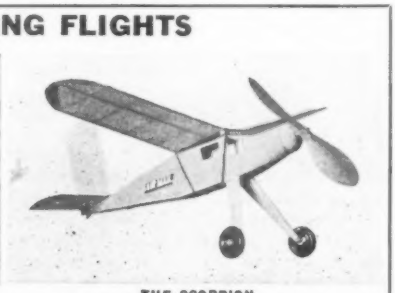

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program for the U. S. Army Air Corps for 1935.

And out of these hours, only five hours is allowed for combat practice. I would certainly hate to send a pursuit squadron into action against the enemy with only five hours' combat practice that year. It would be a suicide squadron sure enough.

But, they have tried to rectify the errors of the past year, insofar as possible with the limited time. Ever remembering the army airmail scandal, they've devoted nearly half the time—52 hours—to navigation, blind flying, etc. Perhaps, after we have had a good licking in the next war, they'll increase combat practice to ten hours.

* * *

ALL OF our readers should be interested in Mr. Van Vliet's article on how to get a patent. There has been so much misunderstanding upon this subject that this article was written to clear up many points. Very few people really understand what a patent is or its limitations. They think, that upon being issued a patent by the government, that it bears the mark of approval of the government, but such is far from the case. Better read this article and find what a patent is—or isn't.

* * *

WHAT IS the busiest thing around an airplane? Well, Sam Wentworth pointed this out to us when he claimed and proved that it was the magneto.

Says Sam, "A twelve-cylinder engine requires six sparks per revolution. When the engine is turning up 2,000 r.p.m., that's 12,000 sparks per minute, 720,000 sparks per hour, or 16,280,000 sparks per day.

"Now, the average person can count at the rate of about five per second or 300 per minute. It would therefore take him 54,260 minutes or 904 hours to count every spark that the magneto created in one day. This amounts to 37 days, counting steadily for 24 hours per day without sleeping or eating."

* * *

WILL SOMEONE tell me—please—what an endurance flight proves or is good for? Personally, I get as much kick looking at an endurance flight as I do from a six-day bicycle race—and that's not much. Still, it is much healthier than a pylon polishing event even though it is more tedious.

* * *

HENRY FORD said, in a recent interview, that modern business was suffering from the practice of group control, that is, control by boards of directors, committees, advisory boards and the like. The group control system is too cumbersome and slow to function properly.

Nothing, says Mr. Ford, can take the place of the one-man boss acting without restraint. On discovering an error in a decision, the boss can instantly make suitable corrections before much damage is done, something impossible with group control. Before the average committee finds something wrong, argues out a suitable remedy and has acted, the error has generally progressed to the fatal stage. Aviation industry please note.

* * *

WHICH REMINDS me of technical committees — particularly engineering standardization committees—where the man with the loudest voice and the most appealing personality frequently leads the committee astray.

There have been many silly mechanical standards proposed from time to time by engineering committees who, as individuals, should have known better. The fact that our standards are continually being changed by successive committees is ample proof of this.

One man can conceive a brilliant consistent and original idea, but the best that the collective brains of a committee can arrive at is a miserable shoddy compromise of personal opinions. This is one of the worst features of our various present technical bureaucracies where nothing stable can exist without a chairman strong enough to be the real boss.

* * *

AVIATION MAGAZINES, unlike movie magazines, seldom put the portraits of their lady friends on the front covers. Looking them over, one by one, I think that I have learned the reason.

ACCORDING TO the dope available, few if any air-race promoters have made any money from their ventures during the past few years. Even with their wildest and most dangerous exhibitions, the public has failed to come across with sufficient funds to pay expenses in many cases. Perhaps this condition will automatically eliminate the hazards of racing and the attending evils.

* * *

See you later.—J. B. R.

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THE NEW RYAN-ST

An authentic ¾" flying scale model which is complete down to the rivets on the master metal unifoil fuselage covering. What a kit! Printed out balsa parts, clear and colored dopes, lacquers, aluminum wheels, machined parts. All balsa cut to size, turned spinner, and many parts too numerous to mention.

PRICE OF COMPLETE KIT ONLY $1.00 P.P.

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THE NEW LAWRENCE SERIES

Just Imagine!

A CONSTRUCTION SET ACTUALLY CONTAINING--

SOLID MAHOGANY MACHINE CARVED PROPELLER, (Not a marked block of wood or bent piece of metal);
FINISHED HARDWOOD WHEELS Turned to Exact Shape and Scale, (Not circles printed on flat wood);
SEPARATE FINISHED ROTARY MOTOR COWLINGS, Accurately Shaped, (Not a part of fuselage block);
SEMI-FINISHED ACCURATELY CUT FUSELAGE Block, (Not just a rough piece of wood);
INDIVIDUAL AND COMPLETE SET OF INSIGNIA in Correct Colors, Size and Design for Each Model, (Not the same size set for all models);
ACCURATE, SMOOTH WINGS, Cut to Correct Thickness and Semi-Finished, (Not printed on rough, flat wood);
FINE GRAINED PINE STRUTS, Cut to Correct Size, (No bamboo to split and trim);
SEMI-STREAMLINED AXLE-WINGS, When Needed, (Not just a strip of wood);
SPECIAL NICKEL-PLATED PINS for Mounting Wheels and Propeller, (Not usually supplied);
SMOOTH, ROUND HARDWOOD of Correct Size for Exhaust Pipes, Etc., (Not usually included);
QUICK SANDING WOOD FILLER to give Smooth, Non-Porous Surface, (Very seldom furnished);
THREE OR MORE COLORS OF GLOSS LACQUER, (Not one dram vials or water color cakes);
OUR OWN QUICK POLISHING COMPOUND, Producing a Mirror Finish, (Positively a new item to be found ONLY in LAWRENCE ADVANCED KITS);
A SEPARATE BRUSH FOR EVERY COLOR, (Who ever heard of that in a kit before?);
ASSORTED GRADES OF SANDPAPER, (Just another unusual feature);
And Most Important of All, an AUTHENTIC LAWRENCE PLAN accurately drawn to standard ½-inch-to-the-foot scale, including detailed MACHINE GUNS, motor, rigging, etc. Full and Complete Instructions covering Every Detail of Construction and Finishing are included with each kit.

Never before have such remarkable kits been offered; and most amazing of all; the opening of our new factory with many times our former capacity enables us to sell these unusual kits for only 50c each.
LAWRENCE ADVANCED SOLID SCALE KITS for the following famous World War pursuit planes are now ready and all orders will be promptly filled.

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An Actual Photograph of an Actual Model, Not a Real Pfalz, Built from a new LAWRENCE ADVANCED KIT.

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SOPWITH CAMEL
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S. E. 5 A
FOKKER TRIPLANE
PFALZ D-XII
NIEUPORT XVII
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ROLAND D-II

ORDER NOW!

Advanced Pursuit Kits, Only **50c** Each

Add 10c per kit to cover postage, packing and insurance.

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LAWRENCE AIRPLANE MODELS
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Douglas D. C.'s

(Continued from page 286)

perience of the Douglas Company in building metal monocoque fuselages combined with that of the Northrop Company resulted in the present semi-monocoque construction. This construction consists of a smooth stressed skin in contact with closely spaced bulkheads and numerous longitudinal stringers. All parts are securely attached together leaving the skin with very little unsupported area.

Following the acceptance of the type of construction for the plane, the determination of the detailed arrangement and dimensions necessitated approximately 215 individual static and dynamic tests, 100 preliminary tests on specimens of structural elements and well over 100 tests of wing ribs, fittings and small parts.

A great number of destruction tests were made on wing attachment joints and the more important structural details in which these parts were subjected to increasing loads until failure was noted. In this way an accurate check was made on the ultimate strength of the most important structural elements of the ship.

An example of the thoroughness of these loading tests is shown in the analysis of the landing-gear truss. As this truss is an indeterminate structure, the loads in the various members were analyzed by loading a celluloid model having parts made with widths proportional to the moments of inertia of the corresponding members of the actual landing-gear and measuring the deflections.

The completed landing-gear and tail-wheel were subjected to drop tests in which the assemblies were loaded with weight proportional to the weight of the actual plane under full load and dropped from different heights traveling the entire range from the slight shock of a three-point landing to the destructive jolt of a crash landing. The ruggedness and the shock absorbing qualities of these parts at the present time are due to the results obtained in the torture chamber.

After more than eighteen months of experiment and test, the construction of the actual plane was begun. The fuselage was assembled on one jig. The general procedure consisted of clamping the bulkheads or frames to their respective stations and riveting the longitudinal stringers to the frames. The skin was then riveted to both frames and stringers.

The wing was constructed in five major sections: the center-section and the leading and trailing-edge sections of both port and starboard outer wing panels. The wing-tips and the motor nacelle shells complete with firewall installation were constructed on separate jigs.

The completed fuselage and center wing-section were removed from their jigs upon completion and assembled preparatory to a proof-test. The flanged bolt joints on the outer edges of the center-section, to which the outer wing panels are bolted, were securely attached to rigid steel-test jigs with the fuselage acting as a cantilever beam. Weight was then applied to all points of load concentration, namely: the forward mail compartment, passengers' cabin, rear baggage compartment and the horizontal tail surfaces.

This set-up closely approximated the attitude of the ship in actual flight and the affect of weight upon the structure suspended between the test jigs resembled the affect that weight would have upon the completed ship in the air. The variation under this stress was noted, but upon removal of the load, no permanent set or strain was in evidence. The results of this test showed that the fuselage possessed strength and rigidity

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Combination Land and Seaplane with Floats

32" Span, Weight 3½ oz., Color, Yellow and Drab

Here is one of the greatest values in models ever offered, from the latest army plane it is convertible into Lindbergh's Lockheed Seaplane. Has fine lifting power, takes off from land or water in a few feet. Set has all parts printed on balsa including float formers, turned cowl front, celluloid wheels, insignias, large detail drawing, movable ailerons, tail and rudder.
Const. Set Postpaid..... $2.75

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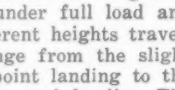

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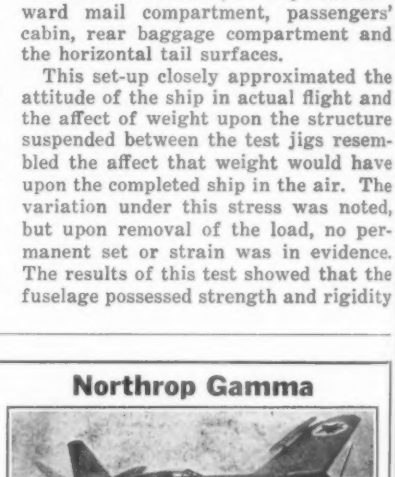
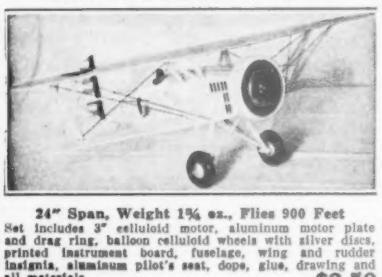


36" Span, Weight 3½ oz., Flying Model

This is a beautifully streamlined model of Capt. Hawks' TEXACO GAMMA. It is complete in every detail, has special streamlined aluminum cowl, 3" celluloid motor, celluloid wheels, tail wheel, all parts printed on balsa, silver, red, black dope, drawing insignia, etc.
Complete Const. Set Postpaid..... $3.75

Curtiss Sea Hawk P3A



24" Span, Weight 1¾ oz., Flies 900 Feet

Set includes 3" celluloid motor, aluminum motor plate and drag ring, balloon celluloid wheels with silver discs, printed instrument board, fuselage, wing and rudder insignia, aluminum pilot's seat, dope, glue, drawing and all materials.
Const. Set Complete..... $2.50
Same Set with 3⅜" Scale celluloid Hornet Motor without cowl. Postpaid..... 2.95

Boeing F4B4 Pursuit

22½" Span, Weight 2¼ oz., Flies 750 Feet

Set contains 3" celluloid motor, aluminum drag ring and motor plate, ribs and formers printed on balsa, celluloid wheels, silver discs, wing, rudder, Army and fuselage insignia, semi-finished prop., yellow and silver dope, glue, drawing and all materials.
Const. Set P. P..... $2.95

Curtiss Army Hawk P6E

24" Span, Weight 2¼ oz., Flies 800 Feet

The strongest and most perfect model of the P6E on the market, has squadron insignia on pants and fuselage, metal exhaust pipes, aluminum wheels, 2 color dopes, all parts printed on balsa, printed instrument board, semi-scale fibre prop. Const. Set Complete. Postpaid..... $2.50

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to withstand a great overload with safety.

In conjunction with this test, the torsional strength of the fuselage was tested by applying the full design loads to the vertical fin with the fuselage still cantilevered from the test jigs at the ends of the center wing section.

A wooden frame was built around the vertical fin and connected to a system of pulleys and weights so placed as to impart a twisting or torsional load to the entire rear portion of the fuselage. Not only did this test fail to distort the fuselage, but the deflections across the main openings, such as doors and windows, were so small that even the close fitting cabin door could be opened and closed under full load.

To demonstrate the strength of the engine mount, the entire nacelle structure was tested by applying loads with a hydraulic jack attached to a steel plate on the engine ring. This test showed small deflection under maximum load.

To eliminate all possibility of control flutter at the high speeds obtained by the transport, all control surfaces and their supporting structures were vibrated by means of a specially designed electrically driven oscillation machine. The respective frequencies of the control surfaces and their supporting members were determined, enabling these parts to be designed far enough out of phase with each other so that flutter was eliminated and vibration dampened to a minimum.

Static tests were made on the control surfaces, both metal and fabric covered types, by loading them to the maximum loads expected in flight as suggested by the results of the wind-tunnel tests in conjunction with the new Department of Commerce regulations. Supporting 40 percent of the ultimate load, each control surface was moved through its entire range to determine that there was no binding due to excessive deflection.

The wing flaps or "air brakes" were tested to 100 percent load when depressed to 30 degrees, although the maximum load occurs only when the flaps are full down.

At the conclusion of the ground tests, the ship was taken into the air where every known method of flight test, including a few new ones invented for the tests, was used in an effort to locate weaknesses not discovered in the loading tests. Every maneuver from screaming power-dives and brutal pull-outs to hard pancake landings was tried but the ship refused to shed its wings in the air or fold up on the ground.

It may be said that this ship was subjected to more thorough flight tests than any other known type of passenger transport or even military plane. Over two hundred flying hours and fifteen thousand gallons of fuel were used in making these tests, which resulted in several new conceptions in flight testing.

After satisfactorily demonstrating the structural strength of the ship in flight, it was necessary to check the design and wind-tunnel data with mathematical precision. Longitudinal, lateral and directional stability were determined under changing conditions of load, power-output and lift-coefficient with various wing and control surface flap positions and changes in cowling. Quantitative measurement was made of controllability and maneuverability with the three sets of control surfaces until the correct proportion of control effectiveness and control heaviness with proper aerodynamic balance was obtained.

The correct adaptation of ship to engines and accessories required several months to complete. Test runs were made on five different combinations of cowling, oil-cooling and carburetor-air intake systems. Engines from two manufacturers and three types of propeller blades were used in these tests. The object of these flights was to determine the performance which could be maintained from day to day under airline operating conditions and not the peak performance under ideal test conditions.

Performance and controllability under all conditions of engine failure were studied in flight. Single-engine operation was tested with overload and partially dumped fuel load. The final single-engine demonstration was made at Winslow, Arizona, which is at an altitude of 4,200 feet above sea-level.

One engine was cut when the plane had traveled just half of the take-off runway. The plane continued the take-off, climbed over the Continental Divide and flew to Albequerque, 240 miles away, on the remaining engine. An altitude of 1,000 feet was maintained above the ground which necessitated a climb to 8,300 feet when passing over the divide. At no time during this test was the engine allowed to exceed its rated horsepower output.

Landing and take-off tests with and without "air brakes" at different engine speeds were made to establish accurate landing speeds, landing-run, take-off distance, take-off time and the initial climbing angle.

The results obtained from these test flights enabled the Douglas test staff to develop a set of engine curves which made possible for the first time the continual determination of engine horsepower while in flight.

It is interesting to note that these engine curves have since been adopted as standard by the engine manufacturers. Cruising speed charts for the guidance of transport pilots were developed to cover the entire range of cruising powers and atmospheric conditions, changing the usual conception of the most favorable cruising altitudes and increasing the cruising speed at constant power by 18 miles-an-hour at ordinary cruising power.

Aided by acoustical engineers from the Sperry Corporation, the Douglas staff then attacked the problem of sound-proofing the transport with the result that the ship is as quiet and free from vibration as possible.

The primary sources of noise in an airplane are the exhaust, propellers, engine chatter and vibration. The first step in sound-proofing the transport was to reduce these noises as much as possible at their origin. The engines were mounted on special rubber insulators and the exhaust noises were reduced by carrying the exhaust below the wing, allowing the wing to blanket the noise away from the cabin. Each exhaust stack was designed differently to combat resonance. Stress carrying members, leading from wing and engines, were designed to pass beneath the cabin to prevent direct transmission of vibration into the passenger compartment.

The heating and ventilation systems were treated with a sound deadening cement and sound filters were provided at critical points. All furnishings of the cabin were designed to contribute their share to the absorption of sound. Even the metal hand-rails were stuffed with sound-proofing material. There was an assortment of eleven different sound-proofing materials used in the final installation, the weight of which was approximately two hundred pounds.

The thorough sound-proofing of the Douglas lowered the noise level from 98 decibels before treatment to 68 decibels which enables one to carry on conversation in ordinary tones.

The thermostatically controlled heating and ventilation system developed in the transport provides the cabin with a complete change of air every sixty seconds and will maintain an inside temperature of 70 degrees with an outside air temperature as low as 30 degrees below zero. There are additional cool air outlets at each seat so that any passenger can direct a stream of cold air on his face, if so desired.

Completed, the D.C.I. represents over two years of experiment and labor, and a total expenditure of approximately $325,000. That the money and time have been well spent is made evident by the fact that the Douglas Company is swamped with inquiries from all parts of the world. Incidentally, a large stack of orders has trickled in.

The immediate success of the D.C.I., in early test flights, resulted in the plans for the D.C.2. The successor of the D.C.I. is twenty-two inches longer in the fuselage, which with small additional space borrowed from the forward and rear cargo compartments, provides sufficient accommodation for two extra passenger chairs, thereby increasing the passenger carrying capacity of the transport to fourteen persons and permitting a total payload of over 4,250 pounds to be carried.

With the exception of an additional two degrees dihedral and larger area in the tail surfaces, the D.C.2. is structurally the same as the D.C.I. All the outstanding characteristics of performance and comfort of the D.C.I. are embodied in the D.C.2. to an even higher degree of perfection. This fleet of transports is aptly termed "the luxury liners of the airways."

END

Alcohol-Gasoline

(Continued from page 306)

be known locally as "Alcoholina") will be retailed at 25 cents a gallon.

According to the temporary agreement signed between the chauffeurs' representatives and government officials, pure gasoline will be retailed at 25 cents per gallon and alcoholina at 21 cents per gallon.

The distress among the corn growers of South Africa and means whereby they might be protected from the disastrous effects of crop shortages and surpluses continues to be one of the outstanding economic problems of the country, it is stated by authorities. A request was made by the farmers that the government should give favorable consideration to the introduction of legislation enabling the production of motor fuel from corn and other vegetable products. Also that the government should accord protection through customs tariffs to such local manufacturing industries as the production of starch, glucose and the like, thus enabling them while paying higher prices for the raw materials to compete successfully with the imported article. Despite persistent demands for relief in the form of a South African industry to distill power alcohol from corn, the minister of commerce and industries has issued a critical analysis of the proposed industry, pointing out the danger of the government's committing itself to the policy suggested by the promoters.

This statement furnishes details of the high cost of production of alcohol from corn, the cost of distribution and sales of the alcohol and the by-products, and refers to the findings in an investigation made by the United States department of agriculture into the costs of producing anhydrous alcohol in the United States.

There is now under consideration by the Netherlands government the possibility of making alcoholic motor fuel from sugar beets grown in that country. The minister-president has announced that he is considering the appointment of a commission to study all phases of the question. Should the Netherlands government take positive steps to encourage the production of alcoholic motor fuel it would only be following in the footsteps of France and Brazil, it is pointed out by the pro-blenders.

It would at the same time have found, perhaps, a means of reducing the present governmental subsidy to sugar beet growers, reducing indebtedness abroad arising from purchases of motor fuel in foreign producing centers, and providing cheaper sugar to inhabitants of the Netherlands, inasmuch as Java sugar could be sold there considerably cheaper than the government-subsidized beet sugar which is now forced upon the Netherlanders.

Nothing in this communication from a United States government attache in the Netherlands is said, however, as to how the effort would be regarded to force high cost alcohol motor fuel upon the inhabitants.

Alcohol will cost more than gasoline or any other mineral oil product, regardless of how it is produced, hence the addition of alcohol to gasoline imposes a needless burden upon the motoring public. And the increase will be considerable.

It was stated earlier in this article that the danger of alcohol motor fuel in this country had been averted. That statement must be qualified now a trifle. Such danger has been averted under present circumstances, involving a near-shortage of grains. If nature smiles too bountifully and a few years of bumper crops again come about there may be another surplus problem and new attempts at that time to give "relief" by means of alcohol-gasoline blending. For the time being, however, the coast seems clear.

END

Miss Los Angeles

(Continued from page 299)

comfortable and normal manner. Both the engine compartment and the quarter-deck to the rear of the cockpit, are covered with aluminum sheeting. The cockpit itself is of the semi-enclosured type provided with a quick release mechanism by which the upper portion of the cockpit cowling can be thrown off in case of an accident or when the pilot should need to bail-out. A venturi type cowl is placed around the engine, which permits of correct operating temperatures with a frontal width of only 27 inches and a maximum depth of only 34½ inches.

SPECIFICATIONS

Wing span	19'-3"
Wing area	60 sq. ft.
Wing loading	21.65 lbs.
Total length	19'-10"
Propeller diameter	6'- 6"
Power plant	300 h.p.
Power loading	4.33 lbs.
Weight dry	882 lbs.
Gross weight	1,299 lbs.
Fuel capacity	30 gals.
Top speed, approximate	270 m.p.h.
Landing speed, flaps down	60 m.p.h.

The propeller is a Story Special with a Hamilton standard hub. It is provided with a special spinner cap of bullet form and of sufficient size to cover the entire hub. To prevent the spinner cap from wabbling, it is supported by an inner cone which centers the spinner. A circular plate attached to the back of the hub completes the assembly and serves to take the torque of the spinner.

The Menasco "Buccaneer" engine turns above 2,900 r.p.m. at top speed, developing above 300 h.p. The displacement of the piston is 544 cubic inches and the engine weighs about 418 pounds. It is provided with a supercharger which operates at 10.4 times crankshaft speed.

Great things are expected of this ship which will influence future design in racing planes and, possibly, combat plane development. To break away from brute speed and introduce the note of maneuverability, is a new and praiseworthy idea.

END

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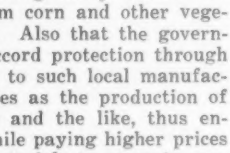

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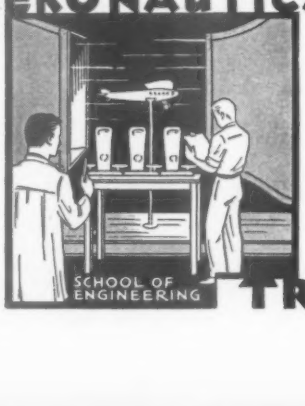

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TRI-STATE COLLEGE

T-2003

(Continued from page 280)

rons bunch together into the close group wedge, from which they can fight back in mutual support of each other. The throttles ease forward, and forward surge the fast weight carriers, all operations going on at top speed.

Five minutes later, contact comes with a roar, three squadrons of enemy fighters evading the American pursuit aviation and throwing themselves in fury at the bombing group from all directions. No assault, support and reserve tactics here. Each of the attacking fighter squadrons comes into assault, the last resort of a desperate foe.

Maneuvering in curious shifting motions, the American fighter group hangs 2,000 feet above their bombers. Occasionally a three-ship element of the enemy comes into their range and the forward or rear guns of the American fighters spit out at them as they scream downward. More often the bombing group is attacked from below. From these attacks they act as their own defense. Only one element at a time can come at them from any direction; six enemy guns against the scores that the bombing group bring into play.

Six enemy fighters glide or spin down to the wet Atlantic, themselves or their pilots crippled or helpless before the first bomber is bagged. Then a punctured oil tank takes its toll of one American engine. Dropping its bomb, the ship keeps on with his one good engine, but dropping slowly behind his fellows. The pilot dare not leave the group and streak for the coast, but it is a losing fight, and gradually his group pulls ahead. Just as he feels himself deserted, a flight of his own fighters drop down to hover about him.

In the distance, the American pursuit is having troubles of its own, shouldering aside another groupment of enemy fighters bent on stopping the advance of the Third Attack Group.

Two green rockets shoot up from the group commander's cockpit, and a moment later the old 96th squadron pulls aside from the group formation's rear. Their prey is the trio of enemy aircraft carriers and an attack squadron far below with a trio of torpedo planes, detaches from its own group and heads with the 96th to where the carriers should be operating. Sixty miles south of the fleet's main body they find them, directed their by their own observation craft.

The squadron splits into three three-ship flights. The attackers, now pulling ahead, also split into three flights of six ships each. The one squadron of fighters, which supports them, hovers overhead alert and ready to fly in where needed. One minute before the bombers drop their eggs, the attack flights make their assault of gas, smoke, light bombs and machine-gun fire.

Deck and anti-aircraft crews of the carriers don gas-masks, cutting in half their own customary efficiency. Smoke wreaths, while not concealing the carriers from the bombers, drift around the anti-aircraft range finders, further impeding the efforts of their operators. Two 30-pounders have hit the flying deck of one of the carriers, ripping it beyond immediate usefulness. One torpedo has found its mark and ripped away the bow of the same carrier.

And then the 96th comes into play. The planes of each flight slide into column, each plane laden with six 300-pound bombs with delay fuses. Each plane noses down slightly as it comes within range of the enemy's 3- and 5-inch AA guns, increasing speed and lessening the time of exposure to AA fire. Their bomb sights operate equally well at any speed. From 12,000 feet their bombs drop, each bomber dropping his six eggs in salvo, their splashes leaving a lengthy pattern around the carriers.

Each flight averages two hits per carrier, one hit in the water near the ship being enough to put it out of commission. One 300-pounder has made a direct hit, going through the flying deck and several more below. A volcano shoots up from the stricken carrier's hull, its gas supply is ignited and flaming like an oil well.

The 96th, its work well done, unites at a squadron rallying point and tears along for the rallying point of the group. In one bomber, a radio man lies dead from a chance shot from the enemy pursuit; in another a badly wounded bombardier lies on his cockpit grating, while the pilot struggles against the handicap of an engine control severed by the same anti-aircraft shrapnel which reached the wounded man. Below them, six of the eighteen attack planes are sinking in the sea. On the other side of the score, the three carriers are also sinking, the third one blazing like a floating inferno.

At this time, action fills the sea and air around the main body of the enemy fleet. The American scouting fleet's cruisers are cutting through the protective screen of destroyers and cruisers about the leading division of enemy battleships, clearing the way for the capital ships of our scouting fleet.

The rear division of enemy battle wagons is now assaulted by the four weapons of the 50-odd attack planes. So dense is the cloud of smoke-borne gas about them that it even enters the ventilating systems of the ponderous ships. There are not enough gas masks to go around.

Destroyers literally cling to the battleships' sides, ready to take the brunt of the torpedo planes' attacks, delivered behind the attack squadron's smoke screens. But one torpedo finds a mark, and that in a destroyer that seems to leap in the air before breaking in two smoking halves.

From the deck, only the handlers of the 50 calibre machine guns perform

(Concluded on page 330)

PEERLESS
WINNERS—

CURTISS SWIFT

Span 27", ¾" Scale, Length 20¾"

A beauty—streamlined for speed. Test model made flights of over 600 feet. Colored Peerless Yellow for the wing, Olive Drab for the fuselage, Silver for the propeller and cockpit inside, and Black for touch-up. All insignia printed in correct colors. Absolutely the biggest value we have ever offered. Kit is complete with Gigantic Plans, PRINTED WOOD, dopes, special wheels, hardwood turned and slotted spinner, insignia, etc. A kit packed with thrills for only... **$2.50**

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CURTISS HAWK P-6-E

Span 15¾", ½" Scale, Length 11¼"

A realistically posed view of this model. The model is fully authentic, patterned after one of the Hawks that was in mail service at Cleveland Airport. Lots of details. Colored Army Yellow and Olive Drab with the Arctic Owl on the fuselage in Black and White. Kit has PRINTED WOOD, colored dope, complete plans, etc. It's a super value at this low price of only..... **$1.00**

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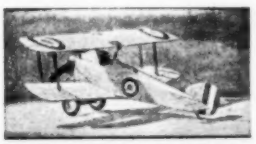

SOPWITH CAMEL

Span 20", ¾" Scale, Length 14⅝"

A favorite with builders of wartime aircraft—very maneuverable. This detailed, authentic model is accurate, real and lifelike—easily built and a great flyer. Test model made flights of over 500 feet. Colored Yellow for wings, tail and fuselage, with Red for nose and struts—a striking combination. Plans are complete and full size. Kit contains everything — PRINTED WOOD, stripe correctly cut, printed insignia, turned balsa cowl with bearing, special hardwood wheels and all quality materials. Price **$1.50**

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Peerless Model Airplane Co.

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Bombing Raid

(Continued from page 329)

their task with any success, the bullets ripping into the wings, fuselage or vitals of many of the low-flying deck strafers. In the turrets the gun crews are shooting low where their fire is not masked by friendly destroyers, sending up a water barrage through which the attack planes find it dangerous to fly.

Up at the 12,000-foot level the three bombardment squadrons have separated at the Group Initial Point upon another signal from the group commander. Each squadron seeks a different altitude, each a different target. Crosswise to the battleships they make their approach, for that is the way that they can sight best. Each three-plane flight squeezes the flanks of its V-shaped formation, the wing men dropping back and moving in toward one another.

Suddenly, the harrassing enemy pursuit turns aside, as AA shells from the three rear battleships and from several nearby cruisers burst about the bombers as they come within range; puffs of bluish white smoke sometimes come remarkably close to the formations but always seem to miss the three-dimensional mark the airplanes represent.

Like the aerial gunners of the bombing planes supporting each other against the assault of enemy pursuit aviation, so the gun crews of the three threatened battleships support one another by firing at any bombing formation on which they can train their guns. Only one bomber succumbs to the hampered efforts of the sky artillery, the stricken monoplane twisting down in a partly shattered mass after a 5-inch H.E. shell bursts square beneath the bomb-bay.

Still the bombers roar onward. In the nose of each ship the bombardier is synchronizing his bomb-sight with the ground speed of his airplane as they near the bomb release line. Targets jump into the sighting wires; each bombardier presses the button, releasing his 2,000-pound bomb from his own sighting. The flights dive slightly and all turn in one direction.

Each squadron has withdrawn. A half minute has passed. Then, like the upheaval of titanic subaqueous quakes, the bombs hit the water.*

Only one bomb from each squadron strikes within the danger area, in the water fairly close to the battleship. Down at 20 feet below the surface the bombs plunge before their delayed fuses function. The hammer effect of the half-ton of exploding TNT is terrific. In each case that one bomb is sufficient to cripple, if not to sink, an erstwhile fighting ship.

Proud ships of the line, approaching their goal with every confidence in the world, they had succumbed to a well-planned, well-executed coordinated air attack! The cost has not been high, except for pursuit and attack planes—a dozen of the latter sinking to the ooze of the ocean's floor.

The air squadrons are converging now on the group rallying point, 15 miles from their target, on the direct route home. The group commander, with no enemy pursuit in evidence, flies forward to take the lead. The squadrons fly into place behind, crowding up into a tight wedge formation. They have done their job. The group commander radioes in his report.

Far below them, their own scouting fleet is coming to grips with the now inferior enemy fleet and the conclusion is a foregone one.

It is certain that more money and more lives would have been lost to us by any other means of defense. The few airplanes lost are negligible in comparison to the cost of money and lives during a naval engagement between our ships and the ships of the enemy. One battleship sunk would have been a severe blow to our organization and would have taken many months to replace, while the loss of a plane would have practically no effect upon the military plans and could be replaced within a very short time.

EDITOR'S NOTE: *The second article in this series will follow in the next issue of* POPULAR AVIATION, *which will enter into related and subsequent operations.*

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WANTED—Licensed small ship. What do you want from the following list: 1931 Indian 45, Buddy Seat, A-No.-1 1930 Willys small sedan, wire wheels, Aeronca 107 motor, new Marshal prop, beautiful shape, instruments, air wheels, Elias Aircoupe duals X3981 Radial Anzani 6-cyl., broken crankshaft, ship OK 86 hrs. Okeo landing gear, HY wing monoplane, not cracked. 20 minutes converts to open job, span 28', chord 7', length 22'. 1931 Ford coupe, 6 wire wheels, new paint, motor overhaul, black body, green wheels, beautiful shape. Photos sent dime each. Also Heath 4 and hub good.—Acorn Service Station, Croton Falls, N. Y.

WILL TRADE Heath Parasol (V) complete with Heath Henderson, two tipped props, tach, full air-wheels, air-speed, altimeter, total (5) hours. Want late light car. Austin preferred. Act at once. —Paul Lowman, Box 14, Warsaw, Ind.

TRADE for light ship—OX 5 motor, with prop. and mag., complete tail group for Waco 10. Also 1930 model Chevrolet coach in good condition. Pay some cash if necessary.—Vernon Scott, Eupora, Miss.

WANTED—Two-place lightplane, prefer Aeronca.—Arthur C. Hyde, Moorefield, W. Va.

HEATH HENDERSON raceplane complete. Ideal for anybody who wants speed. Will sell for price of materials or will trade for good late model car. Will give particulars and photographs upon request.—Aldo Ambrosini, 2304 Butler St., Chicago Heights, Ill.

GOLDEN EAGLE two-place monoplane, Velie motor, ship and motor in good condition. Will trade for light car or $350 cash.—Paul Gallimore, 20 E. 5th Ave., Lexington, N. C.

WANTED—An Aeronca C2, Szekely 35, Continental A40 or similar motor. Have to trade a Meads Glider, has landing gear, with air wheels, a swell flyer, or what do you want?—Charles Lindsey, 1875 E. 70th St., Cleveland, Ohio.

HAVE AMERICAN EAGLE, OX5 job, dual control, new paint job, never cracked, less than 300 hours total time, A-1 condition, 26x5 s.s. wheels and tires. Want Aeronca C-3, or Monocoupe-Taylour Cub. Also want complete set of booklets from "Commercial Aeronautics." What do you want?—Ernest L. Zastrow, 407 E. Carroll St., Portage, Wis.

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WANTED—Good OX5 biplane. Must be in good condition. Prefer licensed ship. Will trade good 1929 model A Ford sport coupe and pay cash.—Percy Lee Curtis, Route 1, Hillsboro, Texas.

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MOTORCYCLE TO TRADE. 1929 Harley Davidson Twin "45." Good tires.—King Daugherty, Booneville, Ark.

WANTED—American Cirrus or any similar American-built engine. What do you want? Also have Stinson Detroiter J-5. Will trade for a Kinner Bird.—Everett Bell Flying Service, Gainesville Airport, Chicopee, Ga.

WANTED—Henderson or Indian four-cylinder motorcycle in good condition. Have Dayton School of Aviation 60-booklet home-study course in exchange. May add cash.—John Tweedin, Box 71, Okauchie, Wis.

HAVE LIONEL BLUE COMET wide gauge train, good condition, also other accessories. Want good 2-cyl. engine, cash, or what have you?—A. Gross, 204 Edgemont Drive, Loch Arbour, N. J.

TRADE new South Bend screw-cutting lathe for Salmson A-d-9 engine in good condition.—Guy Long, 922 Baldwin, Elkhart, Ind.

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HAVE MICROSCOPE, telegraph, camera, electric hot air engine. Trade, cash or both.—Tom Coleman, Maple Bluff, Madison, Wis.

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FOR SALE—Sixteen-ft. speed boat with new 34 Johnston 92 h.p. engine, $375.00. Gies reverse gear $35.00. Will sell engine or hull separately or trade for two-placed airplane.—Russell Iden, 302 Murray Ave., Minerva, Ohio.

YOUNG MAN, aged 21, wants work around airport in exchange for board and flying time. Five months' trade school training.—Lowell Mutchler, Aneta, N. Dak.

High-Lights and Side-Lights

(Continued from page 291)

fact that Turner was present . . . yes, they knew he was around . . . uniforms being what they are.

Doug Campbell and his Sohio outfit put on a whale of a night show . . . and Sohio also brought Gerd Achelis over . . . Outside of flying the Nazi Swastika on the tail-group of his Fokk-Wulf (an arrogant piece of effrontery and unwarranted insult to American aviation—Ed.), Gerd is a nice boy . . . he flies well and autographs divinely . . . Milo Burcham also is getting better with his autographing . . . there's little improvement possible in that boy's flying . . . and 'tis whispered that he's about to hook-up with one of the big oil companies . . . more power to him . . . Milo still has his crazy idea of an inverted transcontinental . . . or should that be transcontinental inverted? . . . But he'd do better to land something permanent and reserve his acrobatics for the Nationals each year.

The usual familiar faces without which no show would be complete . . . Vincent Bendix . . . Herb Sharlock . . . Fred Crawford of Thompson Products . . . Paul Ryan of Shell . . . Fred Caley of Cleveland Automobile Club . . . Incidentally, Fred Caley saw to it that the Nationals' publicity department had frequent sandwiches and things . . . Lou Greve, you know, is one of Fred's intimates . . . and what a pair they are! . . . and, just en passant, Alice Roberts, editor of Fred's Ohio Motorist, should be in Hollywood and not in an editorial sanctum . . . but she's doing one fine job with that magazine that is a consistent booster for aviation . . . Mary Wood and Lois Dunn are two other members of Fred's most able staff . . . There you find ability plus pulchritude . . . and isn't that something to write about?

Now it looks like there will again be races down New Orleans way . . . The boys remember New Orleans coffee . . . and Sazeracs . . . and Ramos fizzes . . . and the Roosevelt Blue Room . . . and Antoine's . . . and mysterious voices from behind half-closed shutters . . . In a word, New Orleans . . . Abe Shushan . . . he's one of Huey's strongest henchmen and the new airport is named for him . . . wants the races there . . . Last February they were somewhat of a financial flop due to the weather, but the public is clamoring for 'em . . . Abe wants 'em . . . the Hendersons are casting eyes thataway . . . so what?

It looks like the 1934 Nationals will show up well in the black . . . and there's no doubt that the 1935 show will be back in Cleveland.

Air race and air show crowds are missing the able announcing of good old Swannee Taylor and Vic Clarke . . . The great publicity job turned in by our good friend Jim Welsh at New Orleans was repeated at Cleveland and I am sure he will be a fixture at the National Air Race typewriter.

The MacRobertson International Air Race has drawn sixty-four entries . . . The outstanding names in world-wide aeronautics will participate in this race . . . There are at the present writing eighteen pilots from this country entered and, out of the sixty-four airplanes entered in the race, twenty-four were built in this country . . . Twenty-seven of the planes are powered with American built engines . . . Only one American is flying a foreign airplane . . . Harold Gatty is entered and will fly a Douglas Transport . . . Roscoe Turner will fly a Boeing Transport . . . Keith Rider in a plane of their manufacture . . . Walter T. Varney a Lockheed . . . Wiley Post a Lockheed Vega . . . Salvador Farre a Percival Gull . . . Wedell-Williams have entered one of their planes . . . Miss Jacqueline Cochran a Northrop . . . Lyon Flight Expedition Co., Inc., a Lockheed Orion . . . John H. Wright a Lambert Monocoupe . . . David Wehman and Paul W. Clough a Cessna . . . Murray B. Dilley, Jr., a Vance Viking . . . Clyde Pangborn has teamed up with Roscoe Turner, but had entered with the intention of flying a Granville job . . . Lt. G. Shaw a British Klemm . . . Russell A. Hosler a Hosler B . . . Miss Ruth Nichols a Lockheed Altair . . . A New York-London-Moscow air-line company have entered a Vultee . . . Miss Laura Ingalls a Lockheed Orion . . . Mrs. Louise Thaden a Beech . . . You will note that four girls from America have entered and that Lockheed leads all companies in type entered . . . Also interesting is the fact that the new Vultee plane will have two chances to come down in front . . . England has twenty-seven entries, sixteen from Great Britain, four from New Zealand, five from Australia and one each from New Guinea and India.

END

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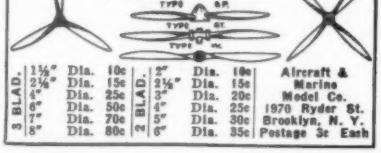

3 BLAD.	1½"	Dia.	10c	2 BLAD.	2"	Dia.	10c
	2½"	Dia.	15c		2½"	Dia.	15c
	4"	Dia.	25c		3"	Dia.	20c
	6"	Dia.	50c		4"	Dia.	25c
	7"	Dia.	70c		5"	Dia.	30c
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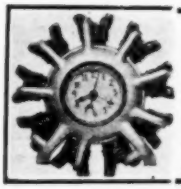

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Practical Lessons

(Continued from Page 311)

will examine the graph shown by Fig. 2 which shows the relation between the angle of attack (a), the lift (L) and the lift-drag ratio (L/D) for a certain airfoil. The values vary widely with different airfoils so that this graph cannot be representative of a single definite airfoil. Tests must be made for each type of airfoil by the laboratory, the accompanying chart being only a typical example of a chart for use in description.

Along the horizontal bottom line are indicated the angles of attack (a) in angular degrees, ranging from -4-degrees to 20-degrees. On the left-hand vertical edge will be found the values for the lift-coefficient (K_y) while on the vertical right-hand edge are the corresponding lift-drag ratios. The curve or graph for finding the values of (K_y) is the heavy solid line. The dotted curve is for determining the value of the lift-drag ratio (L/D) at the given angle.

It will be seen that negative angles (-a) up to -4-degrees are given because this particular airfoil does not lose all of its lift until a negative angle of 4-degrees is reached. It still has some lift left at the 0-degree angle of attack—0.0008 to be exact. The negative values of the angle are to the left of "0" with the positive values at the right.

Looking at the heavy solid lift-coefficient curve, we see that this curve increases approximately along a straight line up to an angle of about 10-degrees and then starts to round over at the top so that the maximum lift is attained at (A), or at nearly 14-degrees. This is the "burble-point" or the "stalling-angle," and the lift then drops off suddenly to (c) with a further increase in the angle. This indicates why a ship will stall suddenly when the angle of the airfoil is increased beyond a certain point.

Different airfoils have different characteristics in this respect, some having nearly flat tops so that there is a range of several degrees where the maximum lift is practically constant. With other airfoils, the drop-off at the burble-point is even more sharp and sudden than indicated on this chart.

An examination of the dotted lift-drag curve shows that the maximum lift-drag ratio occurs at an angle of about 3-degrees, and that it falls off suddenly on either side of this point. Unfortunately, the lift is rather low here, only 0.0014 to be exact. The efficiency is very poor at either very high or very low angles of attack. At 20-degrees, for example, the lift-drag ratio is only 3.0.

To use the chart for any given angle, follow up from the angle as indicated by the arrows starting at (M). At (n), where the arrow intersects the dotted L/D line, follow to the right where the lift-drag ratio will be found on the right-hand vertical scale at 12.0 in this case. Following up vertically from (m) until the line intersects the lift-coefficient curve at (n), chase across horizontally to the left where the lift-coefficient (K_y) will be found—or 0.003 in this case. Thus, for this particular wing, the lift-drag ratio is 12.0 and the lift-coefficient is 0.003 at an attack angle of 12-degrees.

Now, let us take conditions at 3-degrees. Here the chart shows that the lift-coefficient is 0.0014 while the lift-drag is 21.0, a high figure. In other words, a load of 21 pounds only creates a drag of one-pound at an angle of 3-degrees. At the negative angle of -4-degrees, the L/D is only 3.0.

It should be understood that there are many ways of plotting these charts and that the accompanying chart is only one of many, chosen for this first lesson on wing charts because of its simplicity. In the standardized charts issued by the National Advisory Committee on Aeronautics (N.A.C.A), at least four quantities are plotted on one chart—Lift, Drag, Lift-Drag Ratio and center of pressure movement, together with a scale drawing of the airfoil and its ordinates. This, of course, complicates the chart to some extent, but the information is in more compact form.

Graphical charts, while not so accurate as tabulated figures, give a better idea of the conditions and relations of the various factors involved. Relations that would require a long tedious search through a mass of figures can be noted at a glance when a chart is employed. The slope of the lift-curve, the nature of its peak and similar data can be very quickly grasped from a chart. The charts were introduced into this lesson for the simple purpose of illustrating graphically, the relations of lift and lift-drag with variations in the angle of attack.

In a following lesson, we will take up the graphical representation of the center of pressure movement, which is not a minor matter by any means. On a graph, the shifting of the C.P. with varying angles of attack is indicated with unusual clarity and is therefore of great interest to designers because of its relation to stability.

Again, plotting the drag on the chart is of interest, so that in a succeeding issue, this will also be incorporated on the chart. It is interesting to note where the drag reaches a maximum in relation to the lift.

END

Colonel Thaw

(Continued from page 282)

out of control two others and dispersed the remainder."

Another states, that while returning to his lines after destroying an enemy balloon, he attacked two monoplaces, shooting one down in flames. On another occasion he emerged without a scratch from a single-handed encounter with five enemy planes.

These examples well illustrate the statement that he had at least once had every conceivable type of aerial experience. Although not usually ranked with Fonck and Richtofen, because of his few official victories, this trooper of the "cavalerie de l'air" fought in the war so early and so long that even he himself had no conception of the number of his combats or hours spent over the enemy lines.

He could recall, however, at least twenty victories, five of them made after the official method of recognition came to be used. He might have been credited with more, but characteristic of Thaw was his desire for the success of pilots under his command rather than any thought of his own glory.

Another valued souvenir in his collection is the little known wine bottle with its Indian head label. "The Famous Escadrille Lafayette Brand." On the bottle were signatures of Thaw, Lufbery, Johnson, Hall, Biddle, and other Escadrille members bearing the dates of their victories. An historical significance lies in the fact that one of the signatures is that of Paul F. Baer dated April 6, 1918, proving his the first air victory under American colors.

In December, 1918, Thaw returned to the United States as Lieutenant Colonel, commanding Rockwell Field, where he remained until his discharge the following July. Unlike others who became aces in the war, Thaw was seldom heard of in the years that followed. Perhaps it was the terrific letdown, the search for excitement that could never be the same in peacetime.

We next hear of him prospecting in lower California where he remained until 1921 when he married Marjorie Everts Priest of St. Louis. Again the thrill of the air beckoned; he engaged in promotion of lighter-than-air aviation until 1923. Finally, probably losing forever the hope that he could reclaim some of his lost thrills, he settled down to the quiet life of an insurance broker in Pittsburgh. His only other interests were the directorships in a few utility corporations.

Only once, in recent years, has his name blazed in headlines. In September, 1928, he was acting as navigator on an attempted non-stop record flight from New York to Los Angeles, only to crash in Indiana, the result not of shrapnel or bullets, but a little broken oil-line. Thaw was injured in the crash. As far as can be determined, this was his last flight.

END

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Fuselage Design

(Continued from page 307)

For a cabin plane, the roof-line inside must be 40 inches from the floor, therefore our fuselage will be about 48 inches high on the outside if we want a roomy cabin. It will be 24 inches wide.

As the cross section of the fuselage is not a square (see Fig. 3), we have to allow for aspect ratio conditions. This is the relation between the length and width, found by dividing the length by the width. The coefficient is different with different areas.

In Table II, we see that the coefficient for 8 square feet, which is the area of our fuselage, aspect ratio of 2, is .001548 in "C" values.

But on the other hand, if we make a fuselage of the round type, flat at the tail to produce rigidity, our fuselage will be about 30 inches in diameter if it is an open type. We do not have to consider aspect ratio in this case, so we use Table I.

We find the area nearest our case which is 5 square feet, our area being 4.8 square feet, and the corresponding coefficient which is .001471. Thus, we see that the rounded type of fuselage has the least resistance. Of course, by using complicated formulae, a higher degree of accuracy can be had.

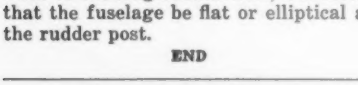
In conclusion, we find that a flat-sided fuselage, in most cases, has more drag than a round type flat at the tail-post or a monoque fuselage. The best type of fuselage with flat-sides should have rounded corners and the general shape as that in Fig. 3 and 4.

The rounded type is much more desirable and should approach the lines of Fig. 5 and 6. A round fuselage should have fineness ratios between 4 and 6 for a lightplane and the maximum diameter should be located at about one-third of the length of the fuselage.

A fuselage of revolution would have the least profile drag, but due to the fact that the rudder area must be kept close to the longitudinal axis, it is better that the fuselage be flat or elliptical at the rudder post.

END

WORLD WAR RELICS



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Epps Plane

(Continued from page 308)

Going back to the rear of the fuselage, we have a few more fittings.

First, there is the short steel-tube mast, welded to the upper longerons, for holding the front part of the fin. Next, weld in the lugs at the bottom of the "V" brace at Sta. 6 which hold the lower end of the stabilizer adjusting arms. A cross-brace carrying a strap fitting for attaching the rear end of the stabilizer is welded between the upper longerons, 4" from the tail-post.

To the latter, weld the lower hinge for the rudder, and the tail skid socket. Finally, attach the stabilizer brace wire fittings. The rear fitting also carries the tail skid attachment bolt, which is 5/16" diameter, welded to prevent turning.

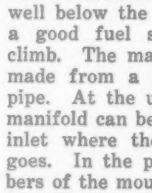
At Sta. 5, a bracket is welded in the middle of the lower cross-member to hold the elevator crank.

I'm taking it for granted that most of you will want to use a Ford motor, so the mount for this power plant is shown in the plans. If any other type of motor is used, you can easily adapt the mount to fit it. The Pietenpol-Conversion motor is used, which has already been described in this magazine, so details won't be repeated here. However, the intake manifold is modified so that the carburetor is located well below the fuselage tank, insuring a good fuel supply in the steepest climb. The manifold extension can be made from a piece of Ford exhaust pipe. At the upper end, the standard manifold can be used by closing up the inlet where the carburetor ordinarily goes. In the plans, the various members of the mount are lettered for easy identification. Notice, in the top view, how the lower support tubes are bent out to provide clearance for the carburetor on the left side, an extra cross-member (f) being installed here. Where the tubes are flattened, they are reinforced by sliding a short length of smaller tubing into the end. The motor bearers are made from ash. The left is wider because it must have a cutaway to fit the oil pump.

The radiator is cut down to the dimensions shown from a 1930 Ford or old-model Chrysler shell and core. It is fastened to the bearers by suitable clips, and is held steady by tie-rods running to the fire-wall as in automobile construction.

In our next issue we will show drawings of miscellaneous fittings, connections and struts used with the Epps plane, and will also give the concluding instructions as to the line-up.

END



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Rockets

(Continued from page 301)

first plane minus a pilot, steered by radio. When that has successfully reached and returned from the stratosphere we will build a large plane and equip it with a rocket motor, and let a pilot go along.

"The first plane we send up should ascend 10 miles in 40 seconds and, when its fuel is spent, it will return to earth by parachute, the parachute being stored in the nose of the missile."

So the young men went to work on their motor. They made the combustion chamber as small as possible, not larger than an egg, to correspond with the quantity of fuel and gas used. The interior was designed to facilitate the movement of the gases and the unburned fuel. And the problem was to get just the right combination of fuel and flames to assure complete combustion before the gases left the expansion nozzle. They found that when they used ordinary rocket powder the gases issued through the nozzle at 860 meters a second. When they used the best smokeless powder, it escaped at 2,100 meters per second—and that with hydrogen plus liquid oxygen it roared out at 4,850 meters per second.

Later, Lieutenant Commander T. G. W. Settle, world's champion stratosphere flyer, who had become much interested in the work and had joined the Cleveland Rocket Society, suggested that the gas-propane be used on the next rocket experiment instead of gasoline.

Then, on a December day, in spite of a stinging wind and blinding snowstorm, the young men decided they were ready to put the final tests to their tiny model rocket. Members of the society crawled into their trenches, donned their tin hats and watched Loebell as he carefully adjusted the fuel valves from behind a steel shield where he could watch the motor's performance in a mirror. Ted Hanna pressed an ignition switch which set fire to the fuel.

Oxygen immediately poured through one inlet and gasoline shot into another at a pressure of 250 pounds. The result was a loud explosion which sent the members of the society scurrying behind their heavy wooden barricades. A minute later the motor leaped up against its mooring in the testing rack. The yellow flames from its exhaust smoothed into a bluish white as Loebell adjusted the fuel valves.

"It's a success," he cried. He explained to the thrilled watchers that if the six-inch motor had been built into a small rocket carrying fuel tanks it could have reached a height of five miles.

Following this experiment, Loebell has drawn plans for construction of a larger motor, two feet long and one foot in diameter, with power enough to lift 1,000 pounds as long as the fuel lasts.

END

Aero-Sportswoman

(Continued from page 292)

the only surviving winner of the famous Thompson Trophy race, until Roscoe Turner won this year's event, is proof that the fame and glory of a racing pilot is short-lived even among the experts.

SIR DEEP ROCK, Jean LeRene's aristocratic little Cocker Spaniel, took the yellow ribbon and third prize in the Dog Show held at the Curtiss Reynolds airport, September 9, which we hope is a good omen.

Jean and her co-pilot, Mary Elizabeth Owens, have been having a series of tough breaks in their attempt to set a new endurance record and are hoping that "Rocky," the new mascot, will bring them luck. The first attempt ended when Mary got an unexpected shower bath during a re-fueling contact. The next time, after *five* full days in the air, a simple little magneto spoiled the picture. Two attempts went by the boards because of "soupy" weather. "We would have been all right if we had stayed here," Jean said, "but we were advised to move to St. Louis to get out of the storm area—and it got so thick that we were forced right down on the ground. The last time we re-fueled we were only about a hundred feet off the ground and Kenneth Hunter said that he couldn't see us half the time, and the ships are only twenty feet apart for the contacts."

However, despite their misfortunes, the girls are not discouraged and hope to stay aloft a month. "We were not the least bit tired after that one five-day period," Mary declared, "and it is not nearly so boring as I thought it might be. There is so much to do all the time, that you don't have time to get it all done before the day is over."

The girls are flying a Curtiss Thrush, equipped with a Wright J6, which burns from ten to twelve gallons of gas an hour. It is necessary to re-fuel two or three times each day. Kenneth Hunter, who helped establish an endurance record over this same airport in 1930, is flying the re-fueling ship.

But, however the result of the attempt may have affected their morale, they have the satisfaction of knowing that they drew a large crowd to the airport each day that they were flying—at least a large crowd for an endurance contest. The manipulation of the refueling hose was watched with tense excitement.

One great improvement that was made, while the girls were grounded on account of the weather, was to equip their plane with a two-way radio, so that they could keep in close touch with their ground crew at all times. "We were to talk to the Byrd expedition this week," Jean said regretfully, "but maybe it can be arranged later."

END

Lightplane

(Continued from page 294)

Wing span.....30'-2"
Airfoil section.....Clark "Y"
Total wing area.....150 sq. ft.
Weight, empty.....635 lbs.
Powerplant, Model A Ford.....60 h.p.
Total cost (approximately).....$500.00

In discussing his project, Mr. Blackburne said meditatively:

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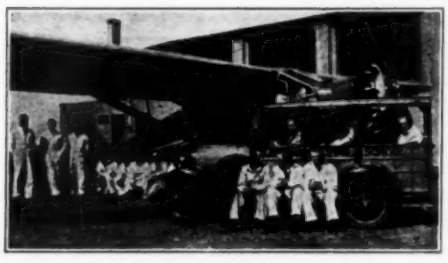

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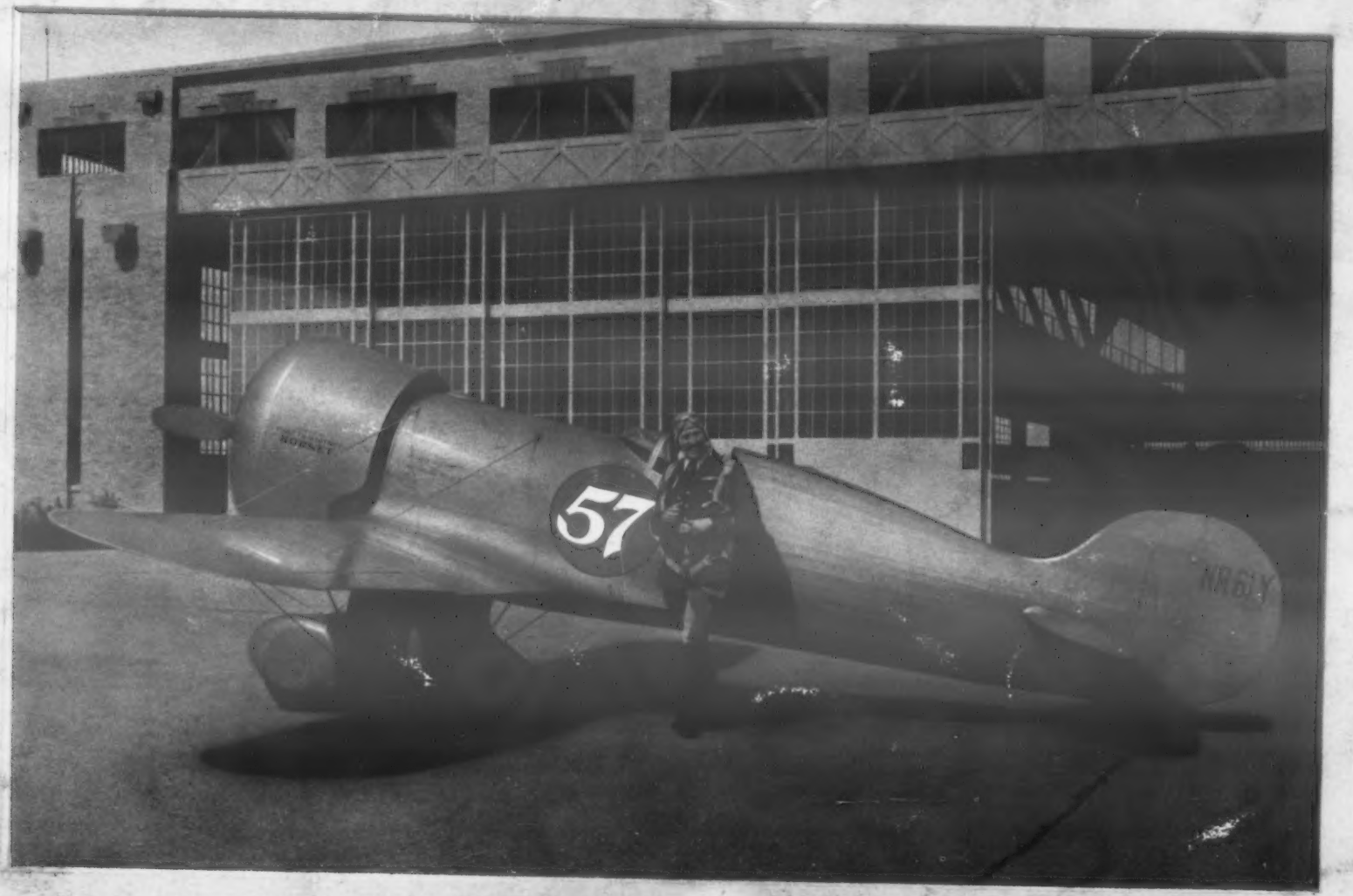

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